Chapter 2
Background

County Council Approved – February 2, 2021

I. NATURAL FEATURES

A. GEOLOGY

Frederick County lies within two of the five geologic provinces located in Maryland, the Piedmont Plateau and the Blue Ridge. The Maryland Geological Survey has four publications detailing the provinces and their properties of Frederick County from which the following data is summarized, see Reger and Cleaves (2008); Dugion and Dine (1987); and Myer and Beall (1958). The Piedmont Plateau Province is divided into a Lowland (western) and Upland (eastern) Section. A large portion of Frederick County lies in the Lowland Section, in a natural central column of the county, which generally extends from the eastern edges of Woodsboro, Walkersville and Frederick City to the eastern slope of Catoctin Mountain. The Lowland Section is generally characterized by a valley of gently rolling terrain and slow-flowing streams. The Upland Section, the eastern slice of the county, is rolling low elevation terrain with major streams in narrow valleys. The Blue Ridge Province is a mountain ridge and valley area of heavily rolling terrain, and deep, restricted, and fast-flowing streams. The Blue Ridge is a narrow geologic province located between the Valley and Ridge (west) and Piedmont (east) Provinces. The South Mountain Ridge divides this Province between Frederick County and Washington County.

1. The Piedmont Plateau Province

Piedmont Lowland Section
The Piedmont Lowland Section is covered by the Regions of Frederick Valley District, Mesozoic Lowland, and Chesapeake Gorges*. The rock type in the Frederick Valley is Frederick and Grove limestones with some diabase intrusion and New Oxford Formation overlying the limestone at its western edge. Its sedimentary rock is easily eroded to form deep soils, whereas the metamorphic and especially the igneous materials of other regions require more time and more severe eroding. Therefore, from the Potomac River northward, this area is characterized by deep soils, streams with shallow banks, and gently rolling land. A quartzite ridge to the east of the section separates this section and its region.

The Mesozoic Lowland Region formed in upper Frederick County and to the southwest of the Frederick Valley is flat to rolling lowlands with red soils, low ridges with diabase dikes and limestone conglomerates with common sinkholes. Upper Frederick County is composed of much the same material as the Frederick Valley, the major difference being that this upper region has not been as heavily eroded. Its soil cover is shallower and its rolling character is due to the harder rock material overlying the softer limestone. The flood plain sediment deposits formed a belt of red sandstone and shale, which crosses Maryland, Pennsylvania, and New Jersey.

Piedmont Upland Section
The Piedmont Upland Region has its roots in the Precambrian Era. Its rock materials are different from those in the Frederick Valley and Triassic Upland Regions, which once probably served as a deposit area for the erosion material from the Piedmont Upland Region. The Piedmont material existed before the formation of the Appalachian Mountains. It has metamorphic, igneous, and sedimentary materials, which are probably related to the volcanic activity that took place during Precambrian time.

The Piedmont Upland Section is encompassed by the Harford Plateaus and Gorges Region and the Wakefield Valley and Ridge Regions. The Harford Plateaus and Gorges Region of Frederick County is made of phyllite, fine grained schists and hard-ledged quartzite. The Wakefield Valley and Ridge Regions is made of phyllitic meta-basalt (Sams Creek), rhyolite, quartzite, and narrow bands of marble.

2. The Blue Ridge Province

The Northern Blue Ridge Section in Frederick County is bounded by the eastern base of Catoctin Mountain and the western base of South Mountain and basically constitutes the Middletown Valley. Cambrian Quartzite weathered into metamorphosed lava, which forms the mountain core, characterizes the area. The quartzite, a weather-resistant material, has served as a deterrent to erosion thereby creating the present mountain valley topography.

The Section is divided into three regions: (1) Catoctin-South Mountain. (2) Middletown Valley, and (3) Chesapeake Gorges*. The Catoctin-South Mountain Region is composed of two prominent quartzite ridges of South and Catoctin Mountains. The Middletown Valley Region is mainly compromised of meta-basalt granite gneiss and sand and silt alluvium in flood area of gorges. Geologic materials found in this Section are similar to those found in the Piedmont Upland Region of the Piedmont Province; that is, they are predominantly metamorphosed rock of igneous origin with similar characteristics.

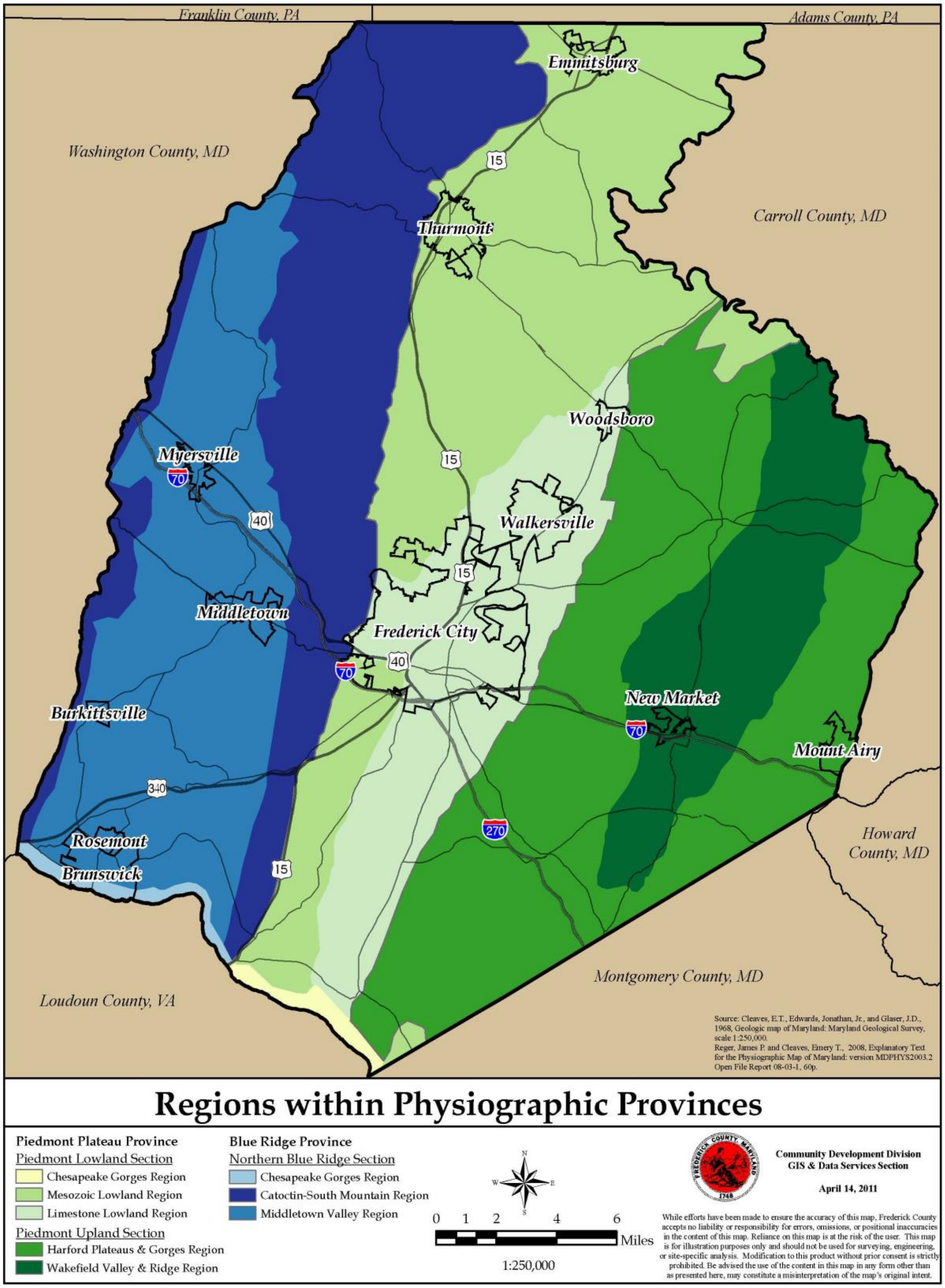
*Chesapeake Gorges Regions

For both Provinces of Frederick County there is a separate Chesapeake Gorges Region. Both locations are carved by the flood plain of the Potomac River. From the western Northern Blue Ridge Section the Region flows over resistant beds of quartzite, sandstone, siltstone, greywacke, phyllite, shale and gneiss through to over Piedmont Lowland Section's carbonate valley mingled with bedrock islands.

Sources: Duigon, Mark T. and Dine, James R., 1987, Water Resources of Frederick County, Maryland: Maryland Geological Survey Bulletin 33, 106p.

Meyer, Gerald and Beall, R.M., 1958, The Water Resources of Carroll and Frederick Counties: Maryland Department of Geology, Mines and Water Resources Bulletin 22, 355p.

Reger, James P. and Cleaves, Emery T., 2008, Explanatory Text for the Physiographic Map of Maryland: version MDPHYS2003.2 Open File Report 08-03-1, 60p.



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Source: Cleaves, E.T., Edwards, Jonathan, Jr., and Glaser, J.D., 1968, Geologic map of Maryland: Maryland Geological Survey, scale 1:250,000.
Reger, James P. and Cleaves, Emery T., 2008, Explanatory Text for the Physiographic Map of Maryland: version MDPHYS2003.2 Open File Report 08-03-1, 60p.
Regions within Physiographic Provinces
Piedmont Plateau Province
Piedmont Lowland Section
Chesapeake Gorges Region
Mesozoic Lowland Region
Limestone Lowland Region
Piedmont Upland Section
Harford Plateaus & Gorges Region
Wakefield Valley & Ridge Region
Blue Ridge Province
Northern Blue Ridge Section
Chesapeake Gorges Region
Catoctin-South Mountain Region
Middletown Valley Region
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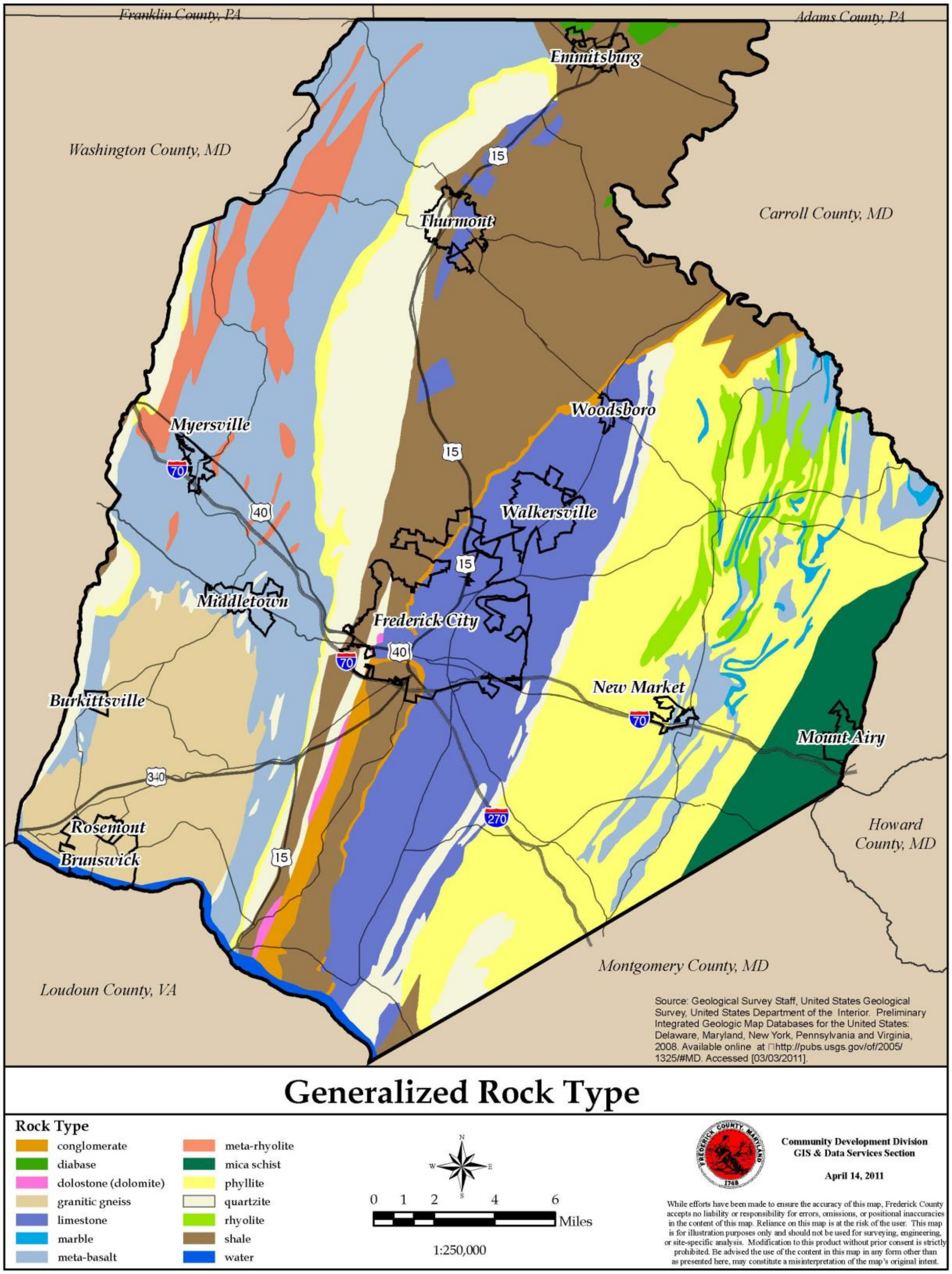

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Source: Geological Survey Staff, United States Geological Survey, United States Department of the Interior. Preliminary Integrated Geologic Map Databases for the United States: Delaware, Maryland, New York, Pennsylvania and Virginia, 2008. Available online at http://pubs.usgs.gov/of/2005/1325/#MD. Accessed [03/03/2011].
Generalized Rock Type
Rock Type
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dolostone (dolomite)
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B. TOPOGRAPHY

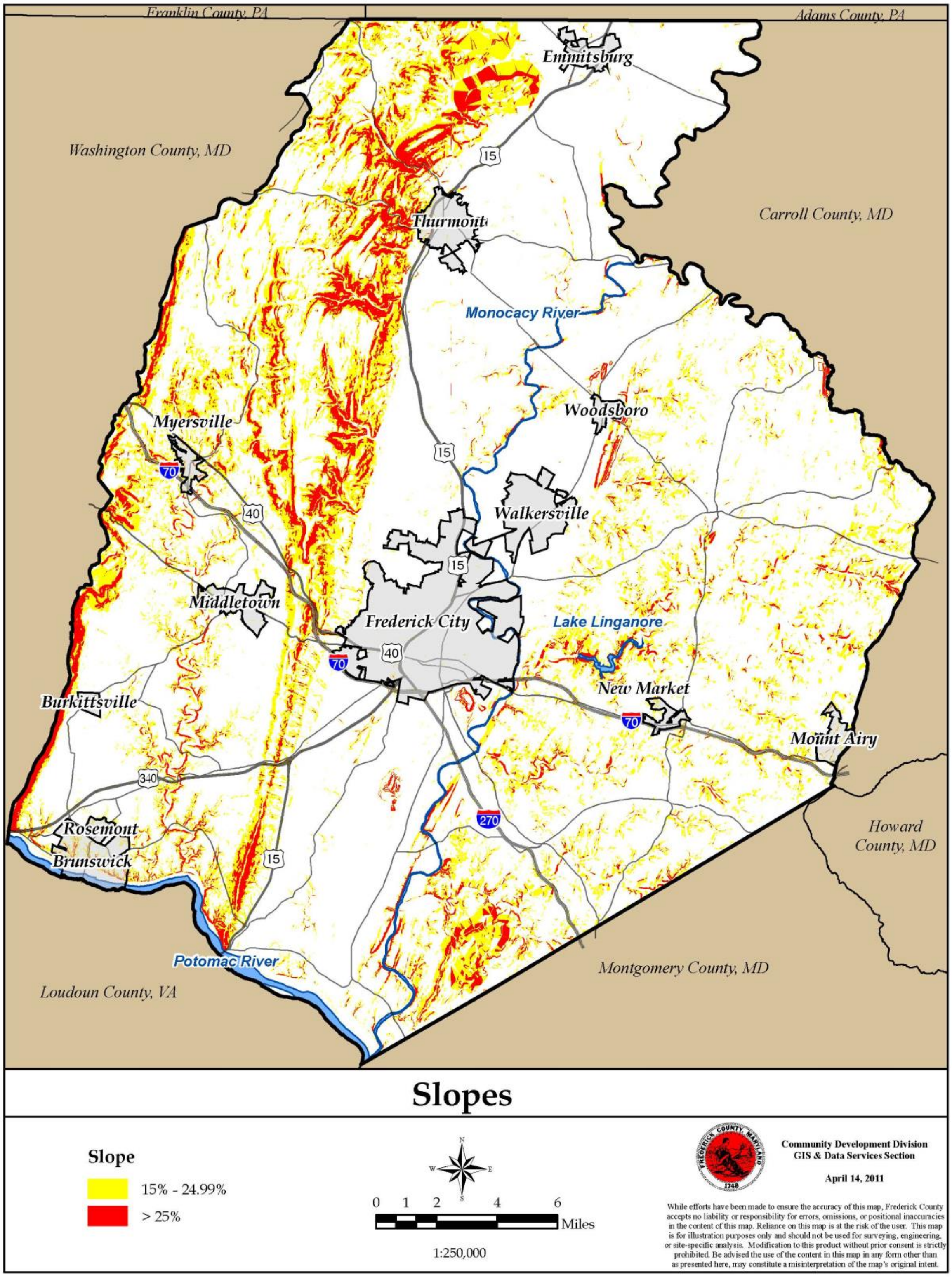
The topographic characteristics in Frederick County range from the low, wide, flat Monocacy River valley to high, steep, mountain slopes. Though the Monocacy's headwaters in Frederick County evolve in the gently rolling Upper Triassic Region (dropping 3.86 feet per mile), they shortly flow into the low level area of the Frederick Valley proper. The Monocacy flows through the Valley in a shallow, slow and widely meandering fashion, dropping 2.32 feet in elevation per mile.

The Piedmont Upland Region, east of the Monocacy River, consists of rolling land. Characteristically, the streambeds are moderately narrow, and high flows produce deep channels in the original bed. The stream flow is east to west, with an average drop of 9.5 feet/mile (Linganore Creek).

The Middletown Valley is best characterized as an intermountain area of steeply rolling land, narrow streams, and rapid fall from north to south. The fall is about 14.0 feet/mile (Catoctin Creek) or about five times that for the Frederick Valley. Surrounding the Middletown Valley on three sides are the Catoctin and South Mountains. The south leg of Catoctin Mountain is wide as compared to the narrow, ridge characteristics of South Mountain. In the north, where the two mountain ridges come together, a steep, elevated mountainous area prevails with peaks, flats, and valleys.

In addition to the mountain ranges, Frederick County has a monadnock -Sugarloaf Mountain. It rises 800 feet above the Piedmont Province to an elevation of 1,282 feet and is characteristic of most mountainous areas, except that the elevation falls off in all directions.

Generally, elevations vary from less than 400 feet in the Frederick Valley to more than 1800 feet in the mountains of the northwest. The elevation of the lower Middletown Valley and the Triassic and Piedmont Uplands is generally between 400 and 600 feet.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C. SOILS

Frederick County's soils have been combined into eleven general graphic groups. The Natural Resource Conservation Service, in 2000 published an extensive revision of the soils descriptions in the County. The physiographic characteristics, soil series and suitability for on-site sewage disposal of the several soil groups are described in the following paragraphs. (For the official copy of soils information, please consult the soil survey at http:/www.websoilsurvey.nrcs.usda.gov/app/HomePage.htm or http://soildatamart.nrcs.usda.gov/

1. Highfield-Ravenrock

These are soils that formed from a mixture of greenstone schist and metabasalt. This map unit occurs in the region of the Blue Ridge that lies between South and Catoctin Mountains and, to a lesser extent, in scattered areas near Sugarloaf Mountain. Slopes range from 3 to 65 percent but are commonly less than 25 percent. Highfield soils are limited for septic tank absorption fields and sewage lagoons because of slope, restricted permeability and depth to bedrock. Ravenrock soils are limited for septic tank absorption fields and sewage lagoons because of depth to saturated zone, slope, restricted permeability and depth to bedrock. Minor soils Catoctin, are very limited due to depth to bedrock and slope. Minor soil Rohrsville is very limited due to depth to cemented pan, depth to saturated zone, slope and depth to bedrock.

2. Bagtown-Stumptown-Edgemont

These are soils that formed from quartzite, metagraywacke, schist, and phyllite. This map unit occurs on the mountain ridges and back slopes of Catoctin and South Mountains. Slopes range from 0 to 65 percent but are dominantly less than 45 percent. Bagtown soils are very limited for septic tank absorption fields because of depth to saturated zone, slope and restricted permeability. Stumptown soils are very limited for septic tank absorption fields because of slope, Depth to bedrock and content of large stones. Edgemont soils are somewhat limited due to slope and depth to bedrock.

3. Myersville-Catoctin-Mt. Zion

These are soils that formed from a mixture of colluvium, metabasalt, meta-andesite, and other rocks of the Blue Ridge. This map unit occurs on summits, on back slopes, on foot slopes, and in drainage ways of the Blue Ridge between South and Catoctin Mountains. Slopes range from 0 to 45 percent. Myersville soils are somewhat limited for septic tank absorption fields because of depth to bedrock and restricted permeability. Catoctin soils are very limited because of depth to bedrock and slopes. Mt. Zion soils are very limited for septic tank absorption fields because of depth to saturated zone, restricted permeability and depth to bedrock.

4. Trego-Foxville-Thurmont

These are soils that formed from alluvium and colluvium of phyllite and quartzite and, to a lesser extent, greenstone and greenstone schist. This map unit occurs on the lower mountain back slopes and foot slopes of South and Catoctin Mountains in the Blue Ridge region. Slopes range from 0 to 5 percent but are commonly less than 5 percent. Trego soils are very limited for septic tank absorption fields because of depth to cemented pan, depth to saturated zone and depth to bedrock. Foxville soils are very limited for septic tank absorption fields because of flooding, depth to saturated zones, restricted permeability, and content of large stones. Thurmont soils are somewhat limited for septic absorption fields due to restricted permeability, depth to saturated zone, and depth to bedrock.

5. Mt. Airy-Glenelg-Blocktown

These are soils that formed from residuum of micaceous schist and phyllite. This map unit occurs on ridges and side slopes of highly dissected landforms of the eastern Piedmont Plateau. Slopes range from 0 to 65 percent but are commonly less than 50 percent. Mt. Airy soils are very limited for septic tank absorption fields due to slope and depth to bedrock. Glenelg soils are somewhat limited for septic tank absorption fields due to slope and restricted permeability. Blocktown soils are very limited for septic tank absorption fields because of depth to bedrock and slope.

6. Penn-Klinesville-Reaville

These are soils that formed in residuum from Triassic red shale, siltstone, and sandstone. This map unit occurs on the part of the Frederick Valley known as the Triassic Basin. Slopes range from 0 to 65 percent but are commonly less than 30 percent. Penn soils are very limited for septic tank absorption fields because of depth to bedrock. Klinesville soils are very limited for septic tank absorption fields because of depth to bedrock and slope. Reaville soils are very limited for septic tank absorption fields because of ponding, depth to saturated zone, and depth to bedrock.

7. Duffield-Hagerstown-Ryder

These are soils that formed from limestone. This map unit occurs in the Frederick Valley from about 1 mile west of the city of Frederick to the Araby Ridge in the east and at the Potomac River as a narrow band that widens to the northeast as far as Woodsboro. Slopes range from 0 to 25 percent. Duffield soils are somewhat limited for septic tank absorption fields because of restricted permeability. Hagerstown soils are somewhat limited for septic tank absorption fields because of depth to bedrock and restricted permeability. Ryder soils, found only in association with Duffield soils, are very limited for septic tank absorption fields due to depth to bedrock.

8. Linganore-Hyattstown-Conestoga

These are soils that formed from micaceous and calcareous schist, phyllite, slate, and limestone. This map unit occurs in the area that is centered on Urbana and runs from the southwest, at the Montgomery County line, to the northeast near Clemsonville. It is bordered irregularly by other soil map units. Slopes range from 3 to 65 percent. Linganore soils are very limited for septic tank absorption fields because of restricted permeability and depth to bedrock. Hyattstown soils are very limited for septic tank absorption fields because of depth to bedrock and slope. Conestoga soils are somewhat limited for septic tank absorption fields because of slope and restricted permeability.

9. Cardiff-Whiteford

These are soils that formed from slate and phyllite. This map unit occurs on a narrow ridge known as the Araby Ridge that runs from Woodsboro in the north to the Potomac River in the south. Slopes range from 3 to 65 percent but are commonly less than 40 percent. The Cardiff and Whiteford soils occur in association with each other. They are very limited for septic tank absorption fields because of depth to bedrock, restricted permeability, slope and content of large stones.

10. Codorus-Hatboro-Combs

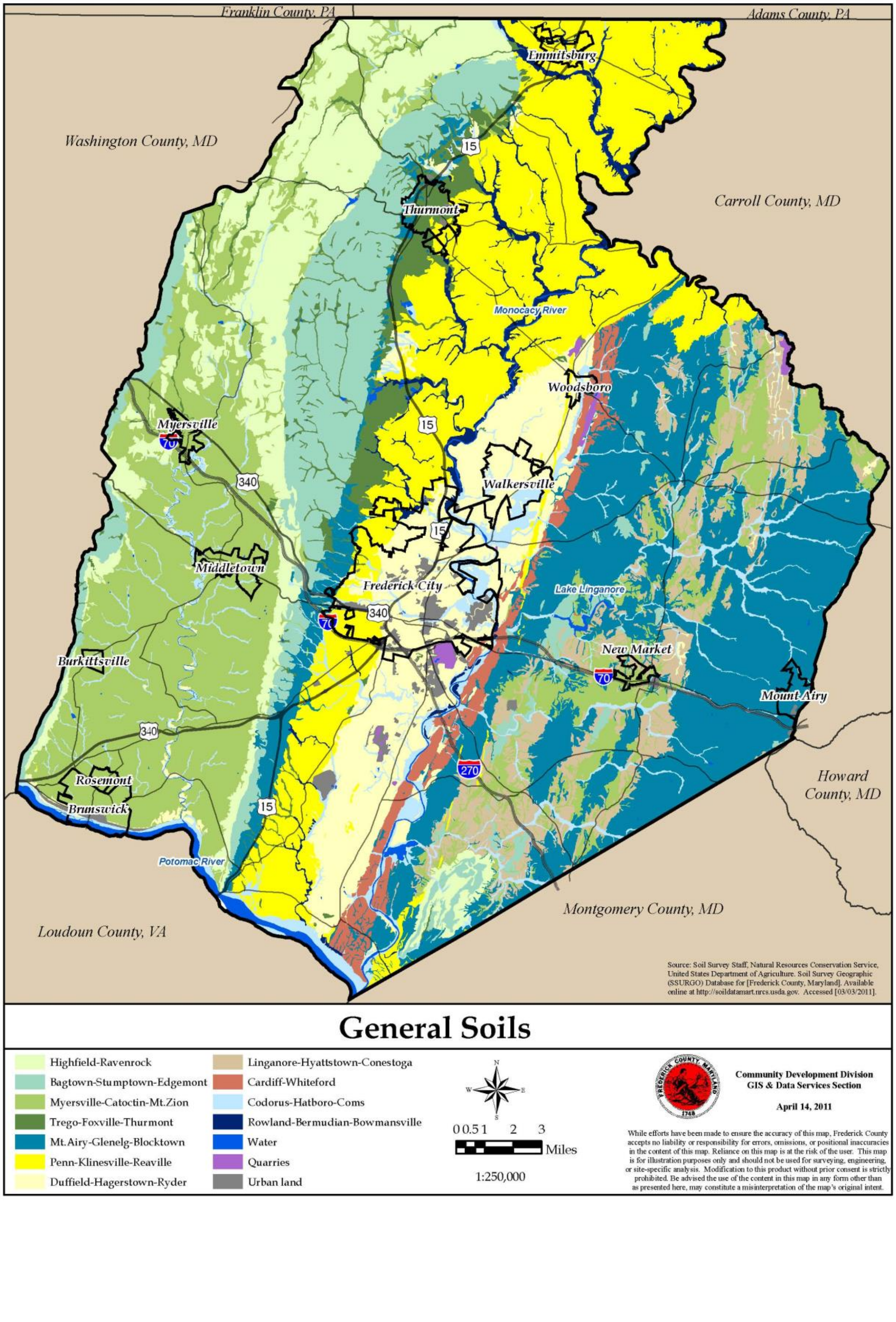
These are soils that formed in alluvium from limestone and mica bearing igneous and metamorphic rocks. This map unit is located around perennial streams and major rivers. The soils all occur in association with each other. They are very limited for septic tank absorption fields because of flooding, depth to saturated zone, filtering capacity, and restricted permeability. Combs soils are only somewhat limited for septic tank absorption fields due to flooding.

11. Rowland-Bermudian-Bowmansville

These are soils that formed in alluvium from red shale, sandstone, and conglomerate. This map unit is located along perennial streams in the part of the Frederick Valley known as the Triassic Basin. Rowland and Bowmansville soils only occur in association with each other. They are very limited for septic tank absorption fields because of flooding, depth to saturated zone and restricted permeability. Bermudian soils are very limited for septic tank absorption fields because of flooding, filtering capacity and depth to saturated zone.

12. Restricted Soils

Because so many of the soil types within Frederick County have moderate to severe restrictions for on-site sewage disposal due to any one or a combination of factors such as permeability, depth to bedrock, seasonal high water table, slope and flood hazard, the local Health Department, with the aid of the Natural Resources Conservation Service (NRCS), has prepared a list of those soils in which percolation for on-site sewage systems is restricted to the wetter season (Restricted Soil Season; February 1 - April 15) of the year.



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Source: Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Soil Survey Geographic (SSURGO) Database for [Frederick County, Maryland]. Available online at http://soildatamart.nrcs.usda.gov. Accessed [03/03/2011].
General Soils
Highfield-Ravenrock
Bagtown-Stumptown-Edgemont
Myersville-Catoctin-Mt.Zion
Trego-Foxville-Thurmont
Mt.Airy-Glenelg-Blocktown
Penn-Klinesville-Reaville
Duffield-Hagerstown-Ryder
Linganore-Hyattstown-Conestoga
Cardiff-Whiteford
Codorus-Hatboro-Coms
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Water
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Table 2.01 Soils Restricted for On-Site Sewage Disposal
Frederick County, Maryland

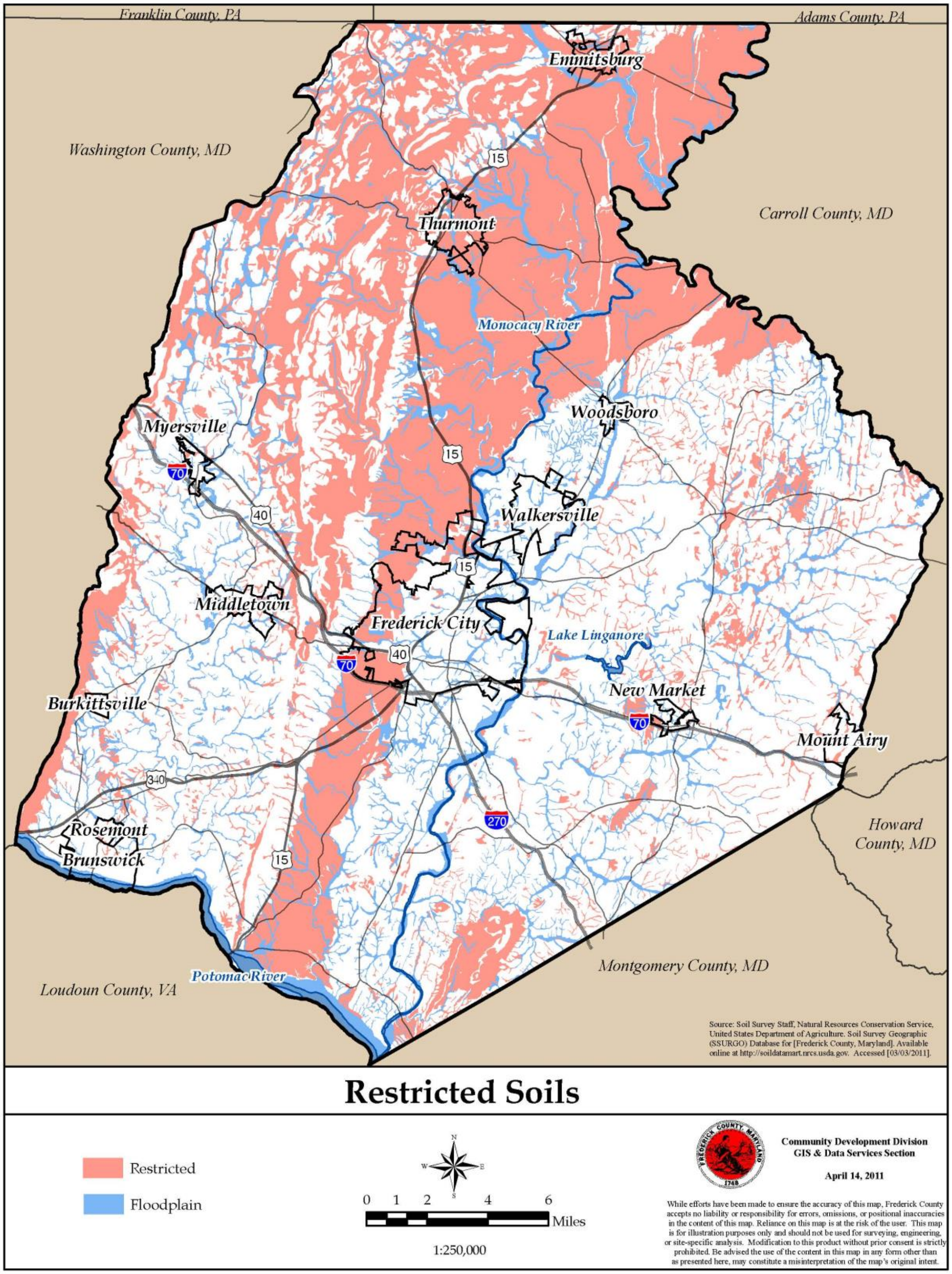
Adamstown (AdA, AdB)
Airmont (ArB, ArD)
Bagtown (BaB, BaC, BaD, BbD, BbE)
Baile-Glenville (BcB)
Benevola (BdB*, BdC*)
Birdsboro (BgA, BgB)
Blocktown (BhE4)
Brinklow-Blocktown (BKD*)
Braddock (BnB, BnC, BoB)
Croton-Abbottstown (CrA, CrB)
DeKalb-Bagtown (DbF)
Dryrun (DqA)
Glenelg (GeB*, GfB*, GgB*, GgC*)
Glenelg-Blocktown (GhB*, GhC*)
Glenville (GoB) (GoC)
Glenville-Baile (GuB)
Hyattstown (HtF*)
Hyattstown-Linganore (HyD*)
Klinesville (KeB, KeC, Ke4D, KnB, KnC)
Lehigh (LqB)
Linganore-Hyattstown (LyB*, LyC*)
Morven (MbA, MbB)
Mt. Airy (MeB*, MeC*, MeD*, MeF*)
Mt. Zion (MmA, MmB, MmC)
Mt. Zion-Rohrersville (MnA, MnB)
Murrill-Dryrun (MtB)
Norton (NoA, NoB, NoC)
Penn (PaB, PeB, PeC, PnB, PnC)
Penn-Reaville (PqB, PrA, PrB)
Ravenrock (RaD)
Ravenrock-Highfield (ReB, RreC, ReD, ReF)
Ravenrock-Rohrersville (RfC)
Readington (RqA, RqB)
Reaville (RmA)
Springwood (SpA, SpB, SpC, SqB)
Springwood-Morven (SrB)
Stumpton-Bagtown (SuD, SuF)
Thurmont (TaB, TaC, ThB)
Trego (ToA, ToB, TqB, TrB)
Watchung (WcB)
Weaverton-Hazel (WeC*, WeD*, WeE*)

* These soils are classified as lower 1/3 landscape position restricted soils.
Source: Frederick County Health Department, 2002

Table 2.02 Floodplain Soils Prohibited On-Site Sewage Disposal

Map Symbol	Soil Name
AtB	Adamstown-Funkstown complex
BfA	Bermudian silt loam
BmA	Bowmansville-Rowland silt loams
BmB	Bowmansville-Rowland complex
CgA	Codorus-Hatboro silt loams
CmA	Combs fine sandy loam
Can	Combs silt loam
FoB	Foxville cobbly silt loam
FxA	Foxville-Hatboro soils
GvA	Glenville-Codorus complex
GvB	Glenville-Codorus complex
Had	Hatboro-Codorus silt loams
LaB	Lantz-Rohrersville silt loams
LsA	Lindside silt loam
MaA	Melvin-Lindside silt loams
MoB	Mt. Zion-Codorus complex
RoB	Rohrersville-Lantz silt loams
RwA	Rowland silt loam
TxB	Trego-Foxville complex
WhB	Wheeling gravelly loam
WtB	Wiltshire-Funkstown complex

Source: Frederick County Health Department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Source: Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Soil Survey Geographic (SSURGO) Database for [Frederick County, Maryland]. Available online at http://soildatamart.nrcs.usda.gov. Accessed [03/03/2011].
Restricted Soils
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D. WATER RESOURCES

Surface Water

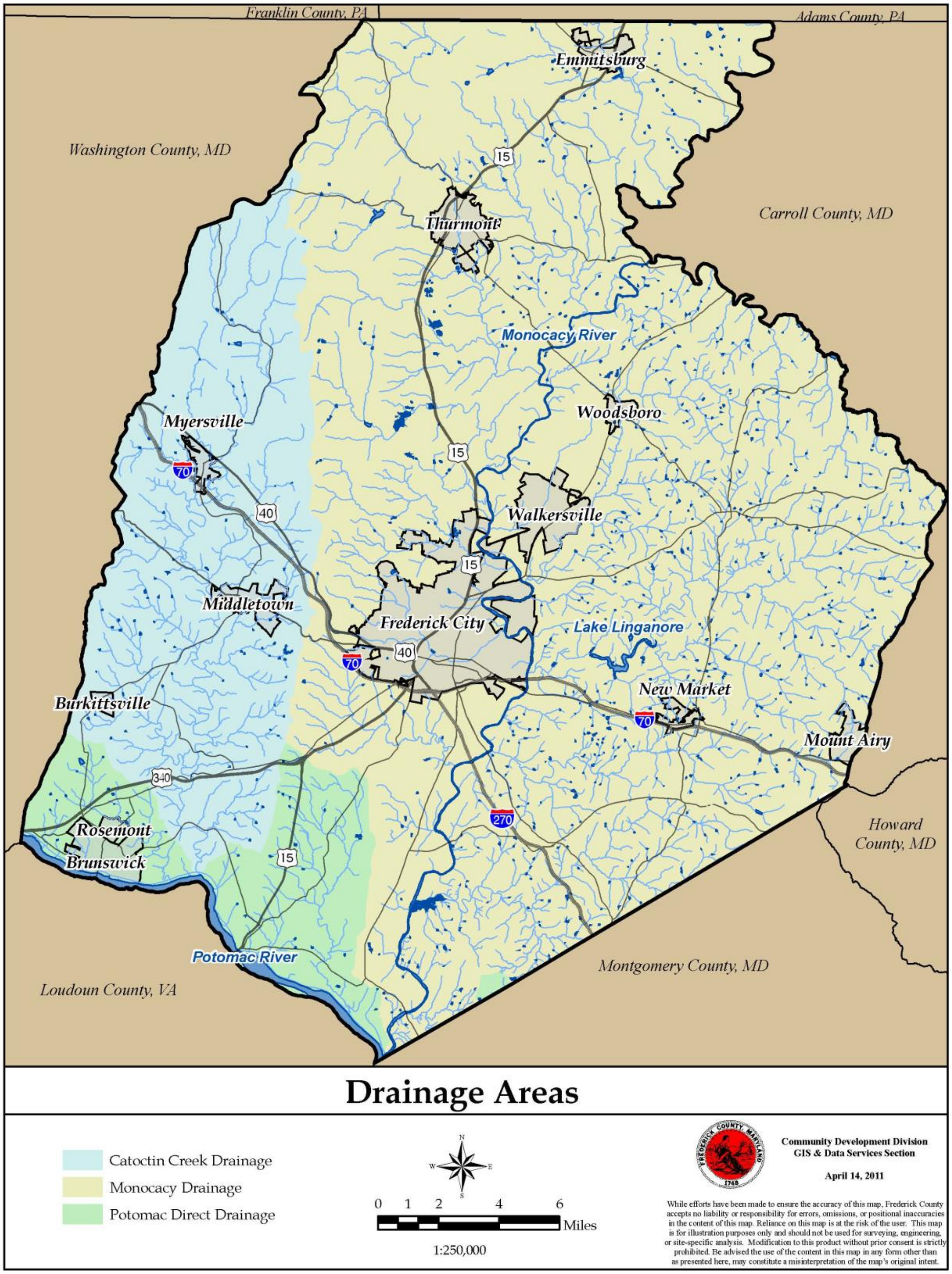
Frederick County's surface waters comprise a small segment of the Potomac Basin and are principally contained in three major streams: the Potomac River, Catoctin Creek (draining most of the Middletown Valley), and the Monocacy River (draining most of the Frederick Valley). Several minor streams - Little Catoctin Creek (draining the Brunswick-Petersville portion of the Middletown Valley). Tuscarora Creek (draining the Adamstown-Licksville portion of the Frederick Valley), and Washington Run (draining the Point of Rocks portion of the Frederick Valley) - flow directly into the Potomac River and complete the principal drainage network. The Patapsco and Patuxent Rivers together drain a small portion of the County, north and south of Mt. Airy, which amounts to about 150 acres. Although Catoctin Creek and the Monocacy River are tributaries to the Potomac River, each has its own distinctive characteristics as a stream and will be discussed separately in the paragraphs below.

1. The Potomac River

The Potomac River drainage basin encompasses a total drainage area of 14,679square miles, including all of Frederick County, 664 sq. mi. (4 1/2% of the total). Run-off in the Frederick County portion of the Potomac Valley is highly diversified in character due to the varied topography and the variety of soil materials found over the large area.

The highest flow on record was a 1936 flow at Point of Rocks of 310,080 MGD (480,000 cfs) (more than 50 times the average flow), which reached a gage height of 41.03 feet. The average flow at Point of Rocks for the period of record is 6,147 MGD. The record low flow was 342 MGD in September 1966, which is about 6% of the average.

Flooding along the Potomac is not as variable as with Catoctin Creek and the Monocacy River. The streambed is wide and shallow with short, steep banks, and there is a distinctive second bank to which overflow waters reach in the event of severe flood conditions.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Franklin County, PA
Adams County, PA
Washington County, MD
Carroll County, MD
Howard County, MD
Montgomery County, MD
Loudoun County, VA
Toms Creek
Emmitsburg
Owens Creek
Thurmont
Hunting Creek
Monocacy River
Middle Creek
Little Pipe Creek
Woodsboro
Glade Creek
Myersville
Fishing Creek
Israel Creek
Tuscarora Creek
Walkersville
Upper Linganore Creek
Middletown
Carroll Creek
Lower Linganore Creek
Catoctin Creek
Frederick City
Lake Linganore
New Market
Burkittsville
Ballenger Creek
Mount Airy
Lower Bush Creek
Upper Bush Creek
Little Catoctin Creek South
Rosemont
Brunswick
Monocacy Direct Southwest
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Community Development Division
GIS & Data Services Section
April 15, 2011
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2. Catoctin Creek

The Catoctin Creek Watershed contains approximately 120.6 square miles and drains 78% of the Middletown Valley. It is bounded by Catoctin Mountain to the east and South Mountain to the west. The area is characterized by steep slopes with stony and shallow soils in the mountain and elevated intermountain areas, and rolling slopes in the lower intermountain valleys.

The steep slopes of the Valley contribute to an average 100-foot drop per mile from the highest point of the watershed to the beginning of Catoctin Creek at Myersville. From Myersville to the Potomac this drop is only about 13 feet/mile.

The soils of the Valley are of low porosity and are, therefore, unable to store quantities of water large enough to adequately feed the streams during long periods of extended drought. Beneath this soil cover there is moderately weather-resistant rock.

Based upon calculations made from precipitation and flow data, the Maryland Geologic Survey estimates that approximately 38% of the total rainfall in the Catoctin Creek Watershed is run-off. This factor, in addition to the topographic characteristics, contributes to flood conditions and rapid flow. Such conditions, although restricted due to topography, can be sufficient to severely damage or destroy any structure or development within its natural path.

The Middletown gaging station is located on the right bank of Catoctin Creek, 300 feet downstream from the Maryland 17 Bridge and 2.2 miles downstream from Little Catoctin Creek. The drainage area at this point is 66.9 sq. mi. or 55.3% of the Catoctin Creek Watershed. The largest peak discharge on record for this station was 12,000 cfs recorded on October 9, 1972. This flow crested at 14.13 feet above the gage altitude of 385 feet. The lowest known flow was 0 recorded in 1966 from 8/27 to 9/12. The average discharge at this station is 76.7 cfs.

The greatest rise on Catoctin Creek (18 feet) was observed in 1885 near what is now the old gaging station below the Route 340 Bridge near Jefferson. At this point the drainage area is 111 square miles or 91.7% of the Catoctin Creek Watershed. Below this point, the Catoctin Creek is subject to flooding from both its own run-off and from back-up of the Potomac River. Naturally, flood levels would be at their highest if Catoctin Creek and the Potomac River reached their crest at the same time.

3. Monocacy River

The primary tributary of the Frederick Valley is the Monocacy River which drains a total area of 970 square miles, approximately 543 square miles of which (56%) is in Frederick County. This drainage area includes portions of Adams County in Pennsylvania and extends from Catoctin Mountain on the west into Carroll County to the east. Generally, the river is slow flowing and meanders in a wide, shallow riverbed with an average drop of 2.8 feet/mile from Pennsylvania to the Potomac River.

The Monocacy tributaries to the west drain areas, which have mountainous characteristics partially similar to those in the Middletown Valley. On the east the drainage areas are more expansive and encompass rolling lands with moderately deep soils.

It is estimated that from 44% to 46% of all precipitation is carried away by the Monocacy River and its tributaries except for Owens Creek, Hunting Creek, and Fishing Creek (all mountain streams), which have over 52-55% run-off. The low average is similar to the Potomac River, but greater than that for the Catoctin Creek Watershed.

The average flow of the Monocacy at the Jug Bridge gaging station is 931 cfs based upon a period of 50 years. When converted to gallons the flow equates to 575.2 MGD. This amounts to a CFSM (cubic feet per second per square mile) of 1.06 or .688 MGD per square mile of watershed. The total yearly runoff is 14.79 inches.

The highest peak flow on record for the Monocacy at the Jug Bridge station is 81,600 cfs which was attained on June 23, 1972 at the height of Tropical Storm Agnes. This flow crested 5.9 feet above the previous record flood (261.9 ft.). In 2003 the Monocacy had the fourth highest flow recorded since record keeping began in 1944.

4. Floodplains

There are three types of regulated floodplains in the County, flooding soils, 100- year floodplain and the historic flood plains. Flooding soils are natural areas where soils are regularly wet or where marsh conditions exist. This flood plain, shown throughout the County, is based upon the soils listed in Table 2-2, which are prohibited from percolation by the local Health Department. Proposed development is constrained to some extent by all three types of floodplain.

The 100-year floodplain is delineated by the Federal Emergency Management Agency (FEMA) in conjunction with their flood insurance program. It is defined generally as the land, which has a 1% chance in any year of being flooded.

The historic floodplain is compiled from historical flood data for three major waterways: the Potomac River, Catoctin Creek and the Monocacy River. Data for these are more abundant than that for the tributaries.

5. Stream Flow Characteristics

Streams may be required to dilute and dispose of liquid wastes, provide municipal or industrial water supplies, provide water for irrigation, maintain suitable conditions for fish and aquatic communities, or any combination of these. Knowledge of low-flow characteristics is necessary to plan for these functions. Many water-quality standards have been based on the 7-day, 10-year low-flow frequency (7 Q_{10}), defined as the lowest mean daily flow over a period of 7 consecutive days, recurring once every 10 years. A large range of low flow per square mile exists among the sub basins. Highest values of 7 Q_{10} are found in the southwestern and southeastern tributaries to the Monocacy, and the lowest values are found in the northern tributaries and in the Catoctin Creek drainage basis.

Groundwater

1. Sources

Most groundwater in Frederick County originates locally from precipitation, a portion of which infiltrates into the ground. Water that has descended to the zone of saturation does not move very far horizontally (a few miles at most) before being discharged to one of the numerous streams in the county. Water may evaporate directly or be transpired through plant leaves, re-entering the atmosphere and completing the hydrologic cycle. Under some circumstances, a well may induce water from a nearby stream to replenish water pumped from the aquifer.

The boundaries of a ground-water system may be difficult to identify. The upper boundary of a ground water system may be a zone of relatively impermeable geologic material, or it may be the top of the zone of saturation. The individual geologic formations underlying Frederick County are not simple, distinct aquifers because the water-bearing fractures may cut across contacts between lithologies and formational differences may be as hydrologically significant as differences between formations. Individual ground-water flow systems in this area are more commonly bounded a by ground-water divides which generally correspond to the local topography. In some areas (limestone terranes are noted for this), the ground water and surface-water divides may not coincide.

Ground water may occur under unconfined or confined conditions. The upper boundary of an unconfined aquifer is the top of the saturated zone. This surface is called the water table. In the fractured-rock terrane characteristic of Frederick County, water-table conditions prevail where the fractures are numerous and well connected; this is the case for most of the county. In some areas, however, the distribution of fractures may be such that zones of unfractured rock effectively confine groundwater flow, and wells tapping such confined fractures are "artesian wells" because their water levels rise above the level of the intersected fractures.

2. Recharge

Because the aquifers of Frederick County generally exist under water-table conditions and precipitation falls across the entire county, some amount of recharge can occur almost anywhere in the county. Weather and antecedent soil moisture conditions are two important factors governing what percentage of precipitation reaches the ground-water body; this percentage ranges from approximately 12 to 30 percent in Frederick County. Water from other sources can enter an aquifer. For example, when surface runoff causes a stream to rise, some water may move from the channel into the stream banks. Another mechanism of recharge important in some areas is the return of water to the ground via septic tank waste disposal systems.

3. Discharge

Ground-water discharge in Frederick County occurs primarily along stream channels. Discharge into streams is generally diffuse in the noncarbonated terranes, but in the Frederick Valley, many streams can be traced to springs discharging from the Frederick or Grove Limestones, which supply nearly all of the stream flow during base-flow periods. The sustained, or base, flow of a stream is derived from ground-water discharge and, in Frederick County, may be more than half of a stream's annual flow. Much of the ground water in Frederick County eventually drains to the Potomac River.

Some of the numerous springs can be utilized in public water-supply systems. The spring at Fountain Rock, FR DE 42, is the largest in the county and has a discharge that exceeds 1000 gallons per minute. In some areas, springs are more diffuse and are frequently referred to as seepage springs or seeps. Subsurface water is also lost to the atmosphere by evaporation and plant transpiration. Withdrawal of water from wells is another means of ground-water discharge. The impact of pumping on a ground-water system depends on the pumping rate and the location of the well.

4. Groundwater Storage

Ground-water may be stored in the soil, the underlying weathered zone, and in bedrock. The amount of water in storage will depend upon the depth and permeability of the soil and weathered zone, the number of inter-connected joints and faults along with the extent of fracturing in the bedrock, and the individual characteristics of each rock type. The availability and quantity of that supply will depend upon the preceding factors plus topography and the ability of the weathered zone and bedrock to transmit the water in storage.

Except for a few types, the geologic materials, which underlie Frederick County, are generally water-bearing formations of low storage capacity and low transmissibility. Contributing to these characteristics is the high percentage of fine particle soils, together with an extensive stream network. Sandstone (and shale) has a high porosity and because of the abundance of this type of rock in the upper Monocacy River Valley, or the Triassic Upland Region, it has the greatest internal ground-water storage capacity, followed by the lower Frederick Valley with its limestone. However, limestone has the lowest rate of flow while that of sandstone (New Oxford Formation) is somewhat higher. Thus, the implication is that limestone in the lower Monocacy River Valley has large quantities of water stored underground, but due to its slow, non-channel movement, recharge is slow. In other words, wells on the average must be deep to counteract rapid drawdown and slow recharge when not in limestone channels. The water bearing properties and average well yields of rock types found in Frederick County are given in Table 2.03.

When interpreting a group of wells the Maryland Geological Survey (Duigon and Dine, 1987) recommend looking at specific capacity (gallons per minute per foot of well depth) as one high well yield value can result in an elevated mean yield.

In 1969, the U.S. Geological Survey, in cooperation with the Maryland Geological Survey attempted to rank the water yielding character of the geologic units in Maryland in terms of average yield and specific capacity. Average yield is defined as gallons per minute. Specific capacity is defined as the yield in gallons per minute per foot of drawdown. Note the pumping data is from Frederick and Carroll Counties Water Resources, Maryland (Myer and Beall, 1958).

Table 2.03 Water-Bearing Properties of Rock in Frederick County

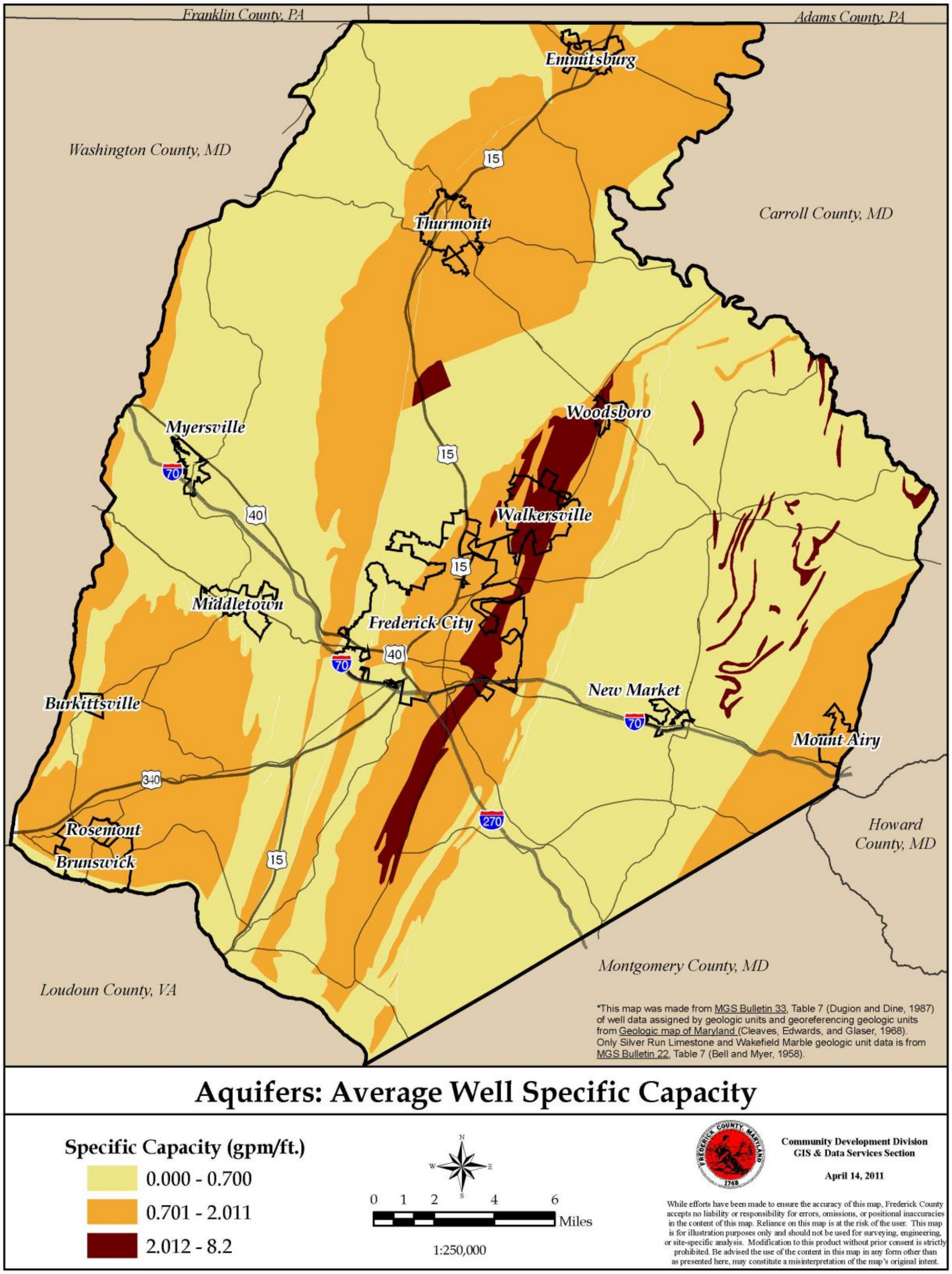
Rock Type	Geologic formations in which it occurs	Average Well Depth (ft.)	Average Discharge or Yield (gpm)	Specific Capacity (gpm/ft)	General Water-Bearing Characteristics
Schist	Antietam formation Metabasalt Marburg schist	100 NA 138	89 NA 22	.673 NA 1.678	Water occurs in fractures, planes of schistosity and shear zones and in weathered mantle. It is a principal source of groundwater. Adequate domestic supplies everywhere and larger supplies locally. Water generally is soft and low in mineral content.
Gneiss	"Injection complex" (intrusive material underlying Middletown Valley) Granodiorite and granite gneiss	NA 59	NA 8	NA 1.8	Water occurs in fractures, along plan of schistosity and in weathered mantle. Important as a source of water in west Frederick County. Adequate domestic supplies generally available and large supplies locally. Water is soft and generally low in mineral content, except for iron locally.
Quartzite	Loudoun formation Weverton formation Antietam formation Urbana formation Sugarloaf Mt. quartzite Marburg schist	161 259 100 160 65 138	8 13 8 16 27 22	.216 1.463 .673 .5 NA 1.678	Water occurs chiefly in fractures. Mantle generally thin. An important source of groundwater. Interbedded quartzite makes moderately good aqua of some of the schist and phyllite that otherwise are mediocre water bearers. Adequate supplies for domestic and limited commercial or industrial use available. Water is generally soft and low in mineral content.
Phyllite And Slate	Loudoun formation Harpers formation Ijamsville formation Marburg schist Urbana formation	161 197 165 138 161	8 12 9 22 16	.216 .625 .365 1.678 .5	Water occurs in fractures and along cleavage planes of slaty rocks. Weathered mantle thin and absent in places. Adequate domestic supplies generally obtainable, but locally only one of several wells may be successful. Little likelihood of obtaining large supplies except under most favorable conditions. Water is soft and low in mineral content.
Metabasalt	Catoctin metabasalt Sams Creek metabasalt	187 118	16 7	.573 .283	Water occurs in fractures and shears and in weathered mantle. Important source of water in western Frederick County. Adequate domestic supplies obtainable but larger supplies rare. Water is soft and low in mineral content.

Table 2.03 (cont.)
Water-Bearing Properties of Rock in Frederick County

Rock Type	Geologic formations in which it occurs	Average Well Depth (ft.)	Average Discharge or Yield (gpm)	Specific Capacity (gpm/ft)	General Water-Bearing Characteristics
Aporhyolite, metarhyolite, and rhyolite	Libertytown metarhyolite **Metarhyolite and associated pyroclastic sediments** Aporhyolite*	183 130 52	8 16 12	.287 .389 .8	Water chiefly in fractures. Weathered mantle generally thin. Moderately important source of water for domestic supplies in western Frederick County. The chemical quality of the water is good.
Diabase	Diabase silts and Dikes	157	19	.421	Water occurs in fractures and shear. Of minor importance as sources of groundwater. Adequate domestic supply obtainable, but not larger supplies.
Limestone, dolomite and marble	Tomstown dolomite Frederick limestone Grove limestone New Oxford formation-conglomerate Wakefield Marble Silver Run limestone* Unnamed bodies of rock	232 171 206 108 143 142 NA	31 24 59 40 16 17 NA	.542 1.585 8.153 1.799 NA .7 NA	Water occurs in fractures and openings, some of which are solutionally enlarged. Rocks are major sources of groundwater. Adequate domestic supplies obtained nearly everywhere. Chances of obtaining moderately large to large supplies are good. Water is hard but otherwise of chemical quality.
Sandstone & shale	New Oxford formation Gettysburg shale	135 166	18 28	.433 2.011	Water occurs in fractures and, to some extent, in the pores of sandstone. Adequate domestic supplies available to wells everywhere; larger supplies will be obtained locally. Water is of good quality generally but locally is hard.

*Only Aporhyolite and Silver Run limestone numbers are from 1958 compiled well data, all other numbers are from 1987 compiled well data.

Source: Table 3, pp. 14-15 of Bulletin 22 (The Water Resources of Carroll and Frederick Counties Maryland Department of Geology, Mines and Water Resources, 1958.
Table 7, pp. 34-35 of Bulletin 33 (Water Resources of Frederick County, Maryland, Maryland Geological Survey, Duigon and Dine, 1987.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*This map was made from MGS Bulletin 33, Table 7 (Dugion and Dine, 1987) of well data assigned by geologic units and georeferencing geologic units from Geologic map of Maryland (Cleaves, Edwards, and Glaser, 1968). Only Silver Run Limestone and Wakefield Marble geologic unit data is from MGS Bulletin 22, Table 7 (Bell and Myer, 1958).
Aquifers: Average Well Specific Capacity
Specific Capacity (gpm/ft.)
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2.012 - 8.2
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II. PROTECTION OF WATER RESOURCES

The State of Maryland has declared "ownership" of the waters, which occur in or flow through the State either above or below ground. As the "guardian" of these waters, the State has adopted policies and regulations regarding the quantity and use of water, which is assigned to the Department of Natural Resources, Water Management Administration (COMAR, Title 08, Subtitle 5). The protection of water quality has been assigned to the Maryland Department of the Environment (COMAR, Title 26, Subtitles 03 through 09).

A. Surface Water

It is difficult to translate the overall goal of clean water into a set of enforceable standards. The most obvious requirements are covered by Maryland's General Standards (COMAR 26.08.02 Maryland Department of the Environment). The Waters of the State shall at all times be free from:

1. Substances attributable to sewage, industrial waste, or other waste that will settle to form sludge deposits that are unsightly, putrescent or odorous to such degree as to create a nuisance, or that interfere directly or indirectly with water uses;

2. Floating debris, oil, grease, scum, and other floating materials attributable to sewage, industrial waste, or other waste in amounts sufficient to be unsightly to such a degree as to create a nuisance, or that interfere directly or indirectly with water uses;

3. Materials attributable to sewage, industrial waste, or other waste which produce taste. odor, or change the existing color or other physical and chemical conditions in the receiving waters to such a degree as to create a nuisance, or that interfere directly or indirectly with water uses; and

4. High-temperature, toxic, corrosive or other deleterious substances attributable to sewage, industrial waste, or other waste in concentrations or combinations which interfere directly or indirectly with water uses, or which are harmful to human, animal, plant or aquatic life. The absence of such substances does not, however, assure the absence of pollution. Research has shown that the subtle physical, chemical, and biological properties of water must be within well-defined limits and that each water use requires a different set of limits.

In Maryland, each body of water has been classified according to the most critical use for which it must be protected as follows:

Use class I: Protected for contact recreation, for fish and other aquatic life, and for wildlife (such protection is sufficiently stringent to protect for use as water supply).

Use class II: Protected for shellfish harvesting. (Frederick County does not have waters in this use category.)

Use class III: Protected as natural trout waters.

Use class IV: Protected as recreational trout waters (waters capable of holding adult trout for put-and-take fishing).

Table 2.04 Water Use Classifications and Stream Designations

USE I: WATER CONTACT RECREATION & AQUATIC LIFE	*Use II: SHELLFISH HARVESTING*	*USE III: NONTIDAL COLD WATER*	*USE IV: RECREATIONAL TROUT WATERS*
Waters, which are suitable for water contact sports, play and leisure time activities where the human body may come in direct contact with the surface water, and the growth and propagation of fish (other than trout), other aquatic life, and wildlife.	Waters where shellfish and propagated, stored, or gathered for marketing purposes including actual or potential areas for harvesting of oysters, soft-shell clams, hard-shell clams, and brackish water clams.	Waters which are suitable for the growth and propagation of trout, and which are capable of supporting natural trout populations and their associated food organisms.	Waters which are capable of holding or supporting adult trout for put-and-take fishing, and which are managed as a special fishery by periodic stocking and seasonal catching.
All Waters not otherwise classified	Not found in Frederick County	-Tuscarora Creek, all tributaries -Carroll Creek, above MD Rt. 15, all tributaries -Rocky Fountain Run, all tributaries -Fishing Creek, all tributaries -Hunting Creek, all tributaries -Owens Creek, all tributaries -Friends Creek, all tributaries -Middle Creek Catoctin Creek's Frostown & Bolivar Branches, Grindstone Run & Musket Ridge -Bennet Creek, Furnace Branch only -Ballenger Creek, all tributaries	-Catoctin Creek, mainstream only below Alternate 40. -Toms Creek, except Friends Creek tributaries -Glade Creek -Little Pipe Creek -Israel Creek -Upper & Lower Linganore Creek -Upper and Lower Bush Creek -Bennett Creek, except Furnace Branch -Monocacy Direct Southwest, except Rocky Fountain Run

Every waterway in the state is at least Class I. Those waters in Frederick County classed as I, III, and IV (Regulation 26.08.02.08, Maryland Department of the Environment) are listed in Table 2-07. Figure 2-F shows the location of each stream so classed. Water quality standards are found at COMAR 26.08.02.03-3

Table 2.05 Summary of State Water Quality Standards

Use I Waters	Use III Non-Tidal Cold Water	Use IV Recreational Trout Waters
Bacteriological: Enterococci—33 or 61 for frequent full body contact (counts per 100 milliliters) E. coli—126 or 235 for frequent full body contact (counts per 100 milliliters)	Same as Use I waters	same as Use I waters
Dissolved Oxygen—not less than 5 mg/liter	minimum daily average not less than 6 mg/liter	same as Use I waters
Temperature—may not exceed 90° F or the ambient temp. of the surface waters whichever is greater	may not exceed 68°F or the ambient temp. of the surface waters whichever is greater. *	Max temp. may not exceed 75°F or the ambient temp. of the surface waters whichever is greater.
pH—6.5 to 8.5	Same as Use I	Same as Use I
Turbidity may not exceed levels detrimental to aquatic life may not exceed 150 units or 50 units as monthly average	Same as Use I	Same as Use I
Color—not to exceed 75 units as monthly average	Same as Use I	Same as Use I
toxic substance criteria to protect: fresh water aquatic organisms fish for human consumption	Same as Use I	Same as Use I Same as Use I and public water supplies for IV-P
	Total Residual Chlorine none	

* *policy of State of Maryland that riparian forest buffer adjacent to these waters shall be retained whenever possible to maintain the temperature.*

Two specific water quality conditions are excepted from these standards. The first is the waterway having a "natural" water quality that is poorer than that allowed by the standards (essentially, "natural" means "unaffected by man" for details consult Maryland regulations). An example would be a case where a stream is eroding mineral deposits (unmined) at its banks and pH or turbidity problems result. It is not the intention of the standards to require correction of this problem.

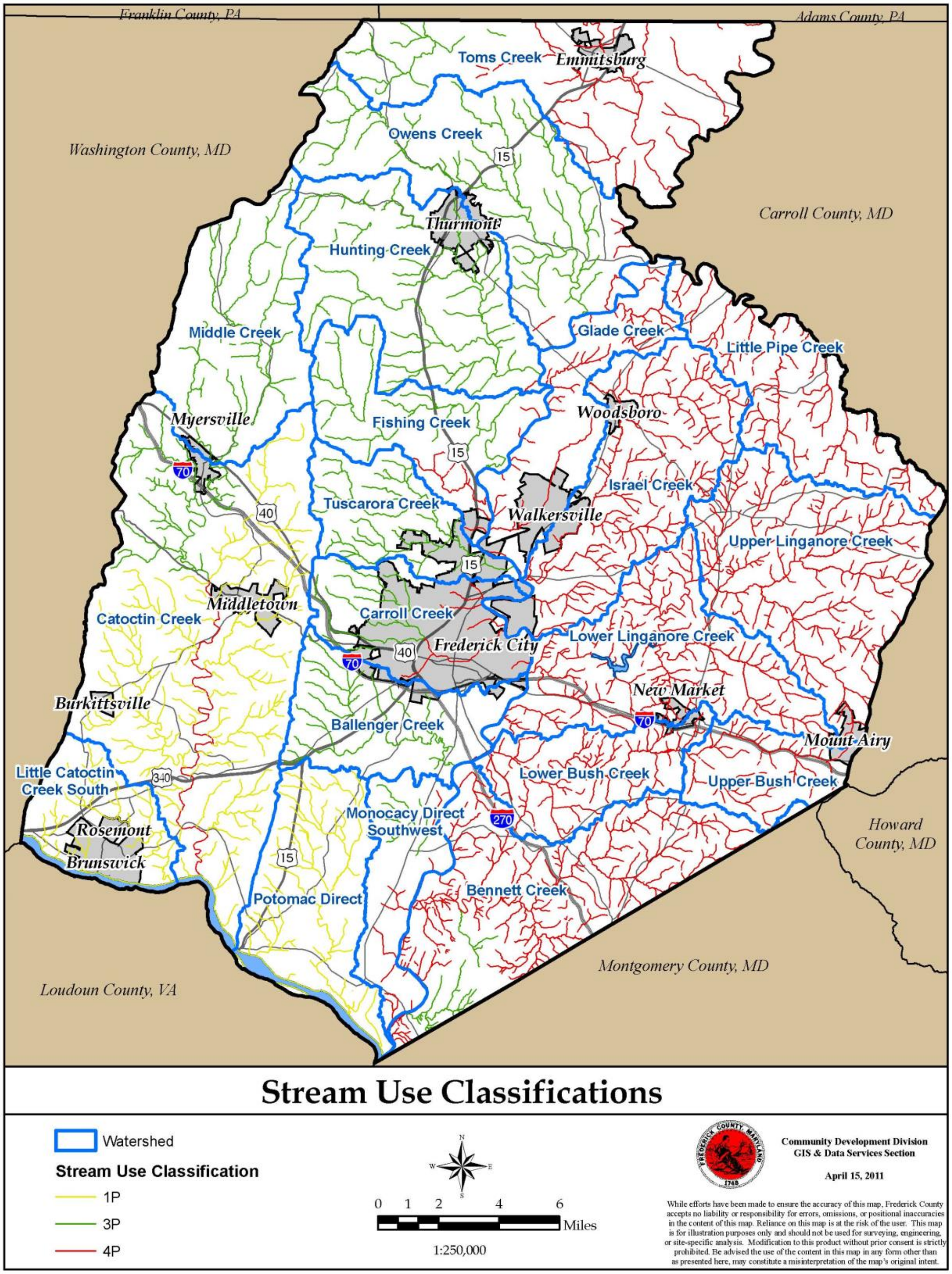
High Quality (Tier II) Waters

The second exception from the state water quality standards is the waterway where existing water quality is already better than the standards, known as Tier II Waters. These waters indicate exceptional water quality, in-stream and riparian habitat conditions as measured by the health of the biological community—fish and insects—in a stream. To protect these high quality Tier II waters, the State has adopted an "anti-degradation" policy and regulatory protections. To implement this policy, state regulations require a Tier II anti-degradation review be performed if proposals for wastewater, stormwater or other discharges result in a new discharge or modifications of an existing discharge into Tier II waters. The regulations also apply to discharges in the watershed located upstream of identified Tier II segments in order to protect downstream water quality.

The Maryland Department of the Environment's Water Quality Infrastructure Program is responsible for coordinating the review of applications for discharges into Tier II waters. The anti-degradation regulation states, "The quality of these waters shall be maintained unless and until it has been demonstrated to the Administration that a change is justifiable as a result of necessary economic or social development and will not diminish uses made of, or presently possible, in these waters."

Four stream segments and their watersheds in Frederick County have been identified by the State as high quality Tier II waters:

1. Big Hunting Creek
2. High Run
3. Weldon Creek
4. Un-named tributary to Talbot Branch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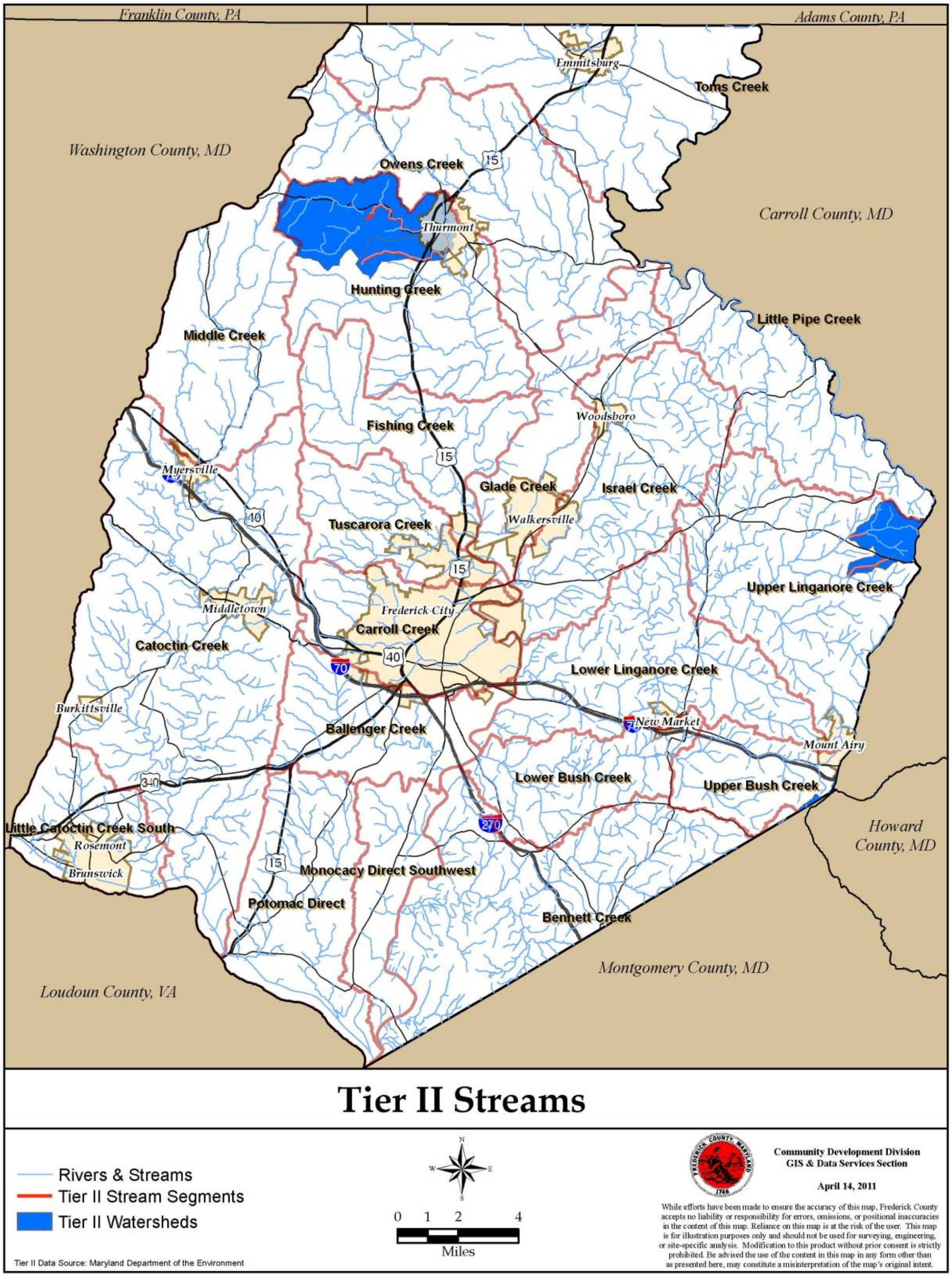
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Montgomery County, MD
Loudoun County, VA
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Rivers & Streams
Tier II Stream Segments
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Tier II Data Source: Maryland Department of the Environment
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Federal Clean Water Act

Since 1972, the Clean Water Act has provided the foundation for our nation's water pollution control programs. Section 101 of the Act states the objective of the Act is to restore and maintain the chemical, physical and biological integrity of the Nation's waters. In order to achieve this objective, it is declared that consistent with the provisions of this Act:

1. It is the national goal that the discharge of pollutants into the navigable waters be eliminated;

2. It is the national goal that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved;

3. It is the national policy that the discharge of toxic pollutants in toxic amounts be prohibited;

4. It is the national policy that Federal financial assistance is provided to construct publicly owned waste treatment works;

5. It is the national policy that area wide waste treatment management planning processes be developed and implemented to assure adequate control of sources of pollutants in each State;

6. It is the national policy that a major research and demonstration effort be made to develop technology necessary to eliminate the discharge of pollutants into the navigable waters, waters of the contiguous zone and the oceans.

Although water quality professionals, lawyers, and public interest groups continue to debate the interpretation of these national goals, meaningful action programs have been established in pursuit of clean water. For example, in response to the objectives of the Clean Water Act, Maryland operates its portion of the National Pollution Discharge Elimination System (NPDES) permit program and manages the Federal construction grants program for sewage treatment facilities--both under delegation agreements from the U.S. Environmental Protection Agency. The State's water quality planning program is a direct outgrowth of the policy expressed in Section 101(a) above.

National Pollution Discharge Elimination System (NPDES)

Each wastewater treatment plant in the County and the municipalities has a NPDES discharge permit issued by the State of Maryland that regulates the amount and concentration of various nutrients and other compounds that can be discharged into waterways. The state also regulates land application of sewage sludge as well as subsurface application of effluent from large-scale septic systems, known as Multi-Use Sewage Systems. NPDES Industrial discharge permits for stormwater cover sites throughout the County; these permits are designed to prevent pollution from industrial activity from entering the storm sewer system. Frederick County Government has 10 facilities covered under these permits.

Frederick County is furthered covered under the Phase I National Pollutant Discharge Elimination System-Municipal Separate Storm Sewer System (NPDES MS4) permit program. This program covers stormwater discharges from developed land, separate from discharges of treated sewage effluent and other types of NPDES permits. Frederick County is a Medium Phase I jurisdiction due to its population. Permit No. 11-DP-3321/MD0068357 requires numerous activities such as watershed assessments, restoration plans for regulatory limits to pollution in certain waterbodies known as Total Maximum Daily Loads (TMDLs), restoration of urban impervious area not treated by stormwater management facilities, illicit discharge detection and elimination, and long term watershed water quality monitoring, all designed to restore and protect water quality in Frederick County and the Chesapeake Bay.

The NPDES MS4 permit also requires biennial Financial Assurance Plans and yearly Watershed Protection and Restoration Plans to ensure MDE and the Maryland General Assembly that the County is financially compliant with its stormwater obligations. The County also submits annual reports to MDE on each anniversary of permit issuance to report on permit-mandated compliance activities. The current permit was issued December 30, 2014 and expires December 29, 2019. Renewal of the NPDES MS4 permit from the State is expected in late 2019.

Total Maximum Daily Loads (TMDLs)

Waterways with water quality monitoring data suggesting impairment (not meeting State water quality standards) are put on a 303(d) list by MDE and evaluated for Total Maximum Daily Loads (TMDLs) for impairing pollutants. The MDE develops TMDLs for impairing substances in waterbodies with allocations to specific entities, such as NPDES permit holders. These are submitted to the U.S. Environmental Protection Agency (EPA) for approval as part of the Clean Water Act. TMDLs for waterbodies in Frederick County include:

- Catoctin Creek: Phosphorus, Sediment
- Double Pipe Creek: Fecal Bacteria, Phosphorus, Sediment
- Lake Linganore: Phosphorus, Sediment
- Lower Monocacy River: Fecal Bacteria, Phosphorus, Sediment
- Potomac River Montgomery County: Sediment
- Upper Monocacy River: Fecal Bacteria, Phosphorus, Sediment
- Chesapeake Bay: Nitrogen, Phosphorus, Sediment

All sectors, such as agriculture, nonpoint sources, septic systems, wastewater permit holders, and MS4 permit holders are assigned load allocations (LAs) or wasteload allocations (WLAs) for the impairing substance in each TMDL. Any load above the allocation needs to be reduced to meet the TMDL. The regulatory obligations for compliance within different sectors vary. Frederick County Government is required by its NPDES MS4 permit to develop plans to meet stormwater WLAs for TMDLs and to put these plans in a schedule. TMDL goals are also written into permits for wastewater treatment plants. Nutrient Management Plans for farms in the agricultural sector have to be consistent with the TMDL. Nonpoint and septic sectors have goals but regulatory enforcement is not as strong as in other sectors. Frederick County Government has prepared TMDL Restoration Plans as part of its MS4 permit compliance and submits yearly updates and has achieved varying levels of compliance.

Chesapeake Bay Protection and Restoration

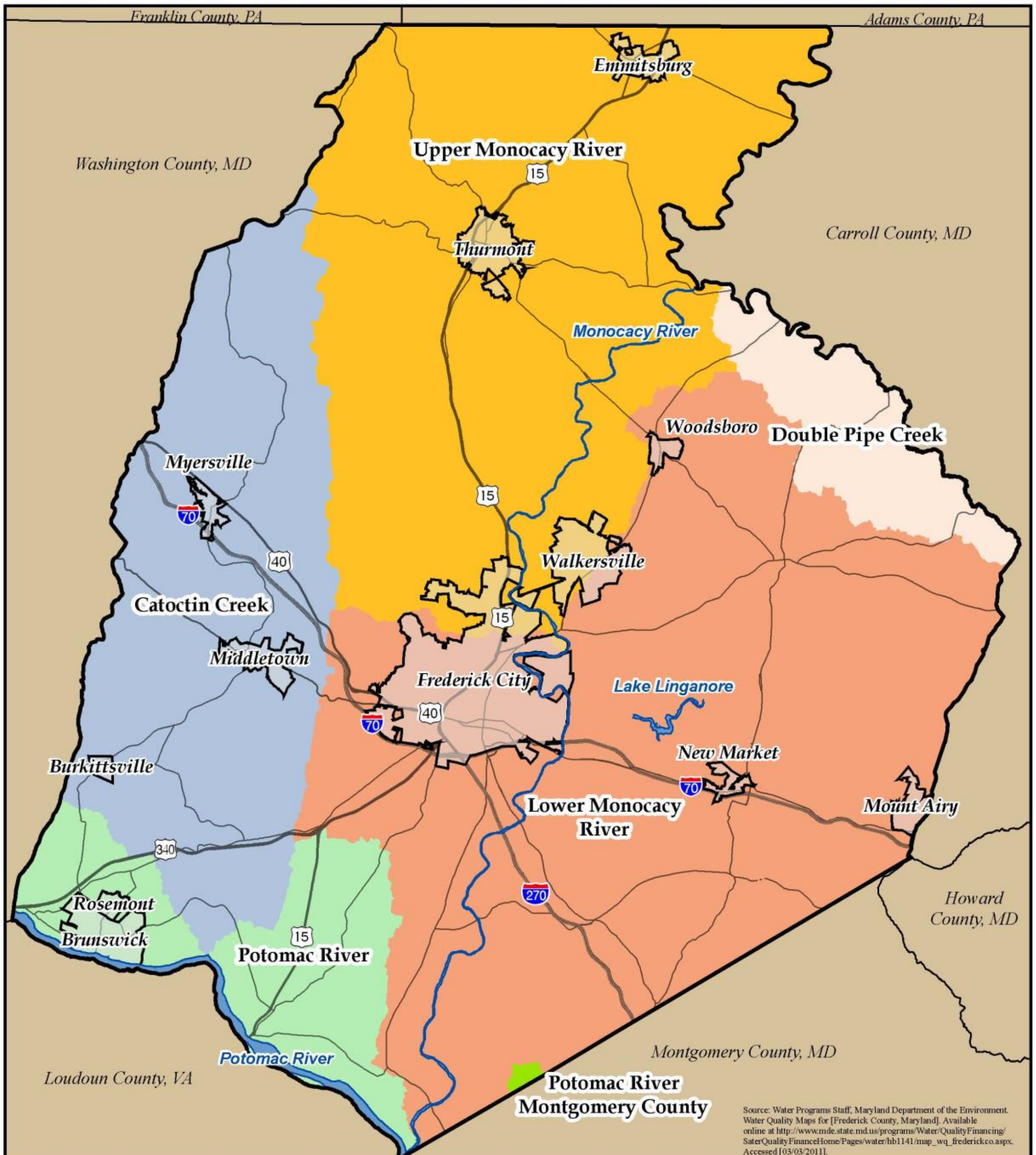
In addition to the nationwide goals for restoring and maintaining water quality, the Federal government has given special recognition to the Chesapeake Bay as a natural resource of major significance. Nineteen eighty-three marked the end of an intensive period of Bay research conducted by the Environmental Protection Agency, and the beginning of a landmark coordinated effort to correct water quality, habitat and resource problems identified by this effort. With the signing of the "Chesapeake Bay Agreement of 1987" by Maryland, Virginia, Pennsylvania, the District of Columbia, and the Environmental Protection Agency, a commitment was made to implement coordinated plans to improve and protect the water quality and living resources of the Bay. To initiate this effort, Federal funds earmarked specifically for Bay implementation actions and long-term resource management became available. This effort was furthered by the subsequent signing of the “Chesapeake Bay Agreement of 2000”, which established additional goals for the health of the Chesapeake Bay and commitments to adopt restoration measures to return the Bay’s ecosystem to a healthy state and to remove it from the federal listing of impaired waters (known as the “303(d)” list from the section of the Clean Water Act) by 2010.

The Federal government acknowledged that the 2010 goals for the Chesapeake Bay would not be met. Litigation over the failure to meet Clean Water Act requirements and Presidential Executive Order No. 13508, *Chesapeake Bay Protection and Restoration*, issued May 12, 2009, ushered in a new and aggressive plan of action to improve water quality, aquatic habitat and living resources of the Chesapeake Bay. A Chesapeake Bay Watershed-wide Total Maximum Daily Load (TMDL) was developed by the US EPA that establishes specific nutrient and sediment targets or loads from all sources and land sectors—agriculture, wastewater treatment, developed and developing lands, and septic systems---within the 64,000 square mile Bay Watershed, which includes Frederick County plus portions of six states (New York, Pennsylvania, Delaware, Virginia, West Virginia, Maryland and Washington, DC).

The Chesapeake Bay TMDL, and its pollutant reduction targets, is the largest TMDL ever written and has implications not just for Frederick County, but all states, counties, cities and towns within the Bay drainage area. In general, the Chesapeake Bay TMDL sets pollutant (nitrogen, phosphorus, sediment) pollution limits for all sources and land sectors by dividing or allocating the maximum allowable pollutant loads, among those sources, that waterways can assimilate and still meet water quality standards. Chesapeake Bay Watershed states are required to develop Watershed Implementation Plans (WIP) that identify target loads to be achieved by various pollution source sectors.

Maryland's Phase I WIP was submitted to the US EPA on December 3, 2010 and includes a series of 75 proposed actions and strategies to reduce sediment and nutrient pollution. Maryland pledged to meet its nutrient and sediment reduction goals by 2020, five years earlier than the 2025 end-date established by the EPA to remove the Chesapeake Bay from the Clean Water Act's 303d listing of impaired waterbodies.

A substantial majority of the actions required under the Phase I WIPs will be carried out at the local---County---level, whether they are stormwater program enhancements, wastewater treatment plant upgrades, adoption of agricultural runoff controls, stream restoration, or septic system upgrades. The Bay TMDL is further subdivided into Phase II WIPs, a geographically-refined, local County-based pollution reduction plan. Frederick County and various stakeholders are required to identify and describe the various pollution control actions and practices to be implemented to achieve the necessary pollution reductions. Frederick County prepared its required Phase II WIP during 2010 and 2011, with submission to the Maryland Department of the Environment on November 11, 2011. The State of Maryland will have a realistic plan for meeting its Phase III WIP targets by 2025 with a Final Phase III WIP by August 2019. This WIP will include goals specific to Frederick County.



Impaired Watersheds

Watershed	Bacteria	Biological	Nutrients	Sediment	Toxics
Catoctin Creek		X	X	X	
Double Pipe Creek	X	X	X	X	X
Lower Monocacy River	X	X	X	X	
Upper Monocacy River	X	X	X	X	
Potomac River		X			
Potomac River MO Cnty		X	X	X	X

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GIS & Data Services Section

April 14, 2011

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B. GROUNDWATER

The USGS/MGS sampled water from 142 wells and 25 springs for analysis. These data may be found in Dine et al, Basic Data Report No. 15, Ground and Surface Water data for Frederick County, Maryland. 1985.

Water quality criteria for drinking water have been promulgated by the U.S. Environmental Protection Agency (USEPA). The standards set by USEPA are generally applicable to public water-supply systems and are based on health aspects of the water consumed. Water for other uses may have to be treated to remove scale-forming substances, which clog pipes; acidity, which corrodes plumbing and equipment; chemicals that cause undesirable reactions in processes requiring a mix with water; or to remove objectionable qualities.

Human factors, such as improper disposal of waste and careless handling of various substances, also affect the quality of ground water, sometimes to a greater degree than natural processes. Buried steel fuel tanks eventually rust, and may leak for some time before being detected; not only does this result in contamination of ground-water, but it can also result in explosive conditions where gasoline is pumped out of the ground by a water well. The state program requiring the finding and removing these underground storage tanks (UST) has done much to alleviate this problem.

Natural protection of ground-water quality in Frederick County is afforded to some extent by such means as filtration by and adsorption on geologic materials. Most renovation of contaminated water occurs in the unconsolidated material overlying bedrock, especially in the shallower portion, which is biologically more active and contains much clay-size material, which provides greater surface area and electrostatic attraction. Open fractures provide little opportunity for renovation; enlarged joints, fractures, and bedding planes have no renovation capacity, and can act as conduits for pollution migration. The Grove and Frederick Limestones are the geologic units most likely to allow conduit flow in Frederick County; consequently, areas underlain by these units require special safeguarding. Proper location and construction of a well can prevent many contamination problems, and this is reflected in State and local regulations.

At present, the cornerstone for Maryland's general policy on groundwater quality is found in COMAR 26.08.02.03. The regulation has three basic provisions:

- All aquifers are to be classified into one of three types, according to their potential for use, as determined by concentration of dissolved solids and by storage and transmissivity characteristics.

- Groundwater quality standards are established for each aquifer.

- A State groundwater discharge permit, issued by MDE is required for each discharge to "underground" waters, except for individual septic systems and certain landfills, which are governed by other regulations. This discharge permit is the State's principal means of controlling discharge of wastes and other potential pollutants to the ground waters of Maryland.

The stipulation that a groundwater discharge permit "will contain limitations and requirements deemed necessary to protect the public health and welfare..." gives MDE broad discretionary powers in regulating discharges to all aquifer types. It is important to note that under the regulations, the burden of proof that an aquifer will not be degraded is on the would-be discharger, not the State. Groundwater discharge permits in Frederick County apply primarily to treated sewage effluent and certain industrial process waters. Decisions on pre-treatment level, application rate, etc., must be made on a case-by-case basis, with site-specific variables, such as soil texture and depth, being of crucial importance.

Groundwater management by the State is largely oriented toward controlling potential pollution sources. As a result, responsibility is spread among a number of different programs within the Maryland Department of the Environment (MDE), each dealing with a different type of potential source. The Department's overall mission is to protect and restore the quality of Maryland's water, air, and land resources while fostering smart growth, economic development, healthy and safe communities, and quality environmental education for the benefit of the environment, public health, and future generations.

Maryland Department of the Environment (MDE)

The Water Management Administration in MDE has a wide variety of duties and functions to restore and maintain the quality of the State's ground and surface waters, manage the utilization of Maryland's water and mineral resources, and protect wetland habitats throughout the State. The Water Supply Program and the Wastewater Permits Program are located within the Water Management Administration. Major functions of the Water Management Administration include:

- Conducting sanitary surveys and comprehensive engineering evaluations of public water systems to ensure that water systems are optimized and reduce the risks of passing pathogens into the drinking water.
- Ensuring public water system compliance with the national primacy drinking water regulations adopted under the Safe Drinking Water Act including public notification procedures.
- Ensuring responsible management, conservation, and equitable development of Maryland's water resources on an aquifer, watershed, or other appropriate geographical basis.
- Providing guidance and technical assistance on County Water and Sewerage Plans to foster smart growth and the regionalization of facilities where appropriate and beneficial.
- Assisting local governments in developing local wellhead protection and watershed protection programs for their public water supply sources.
- Managing environmental health functions delegated to local health Departments.
- Protecting public health and water quality through NPDES permits for surface water discharges—both industrial and municipal—and control of discharges to ground waters of the State through State Ground Discharge Permits.
- Inspecting and maintaining compliance at facilities and activities including industrial and municipal wastewater discharges, agriculture, and construction involving major waste and sewerage facilities, sediment control, stormwater management, wetlands, and waterways.

The Maryland Geological Survey (MGS)

The MGS functions as a research unit, which, often in collaboration with the U.S. Geological Survey, compiles information on quantity and natural chemical quality of groundwater.

Frederick County Health Department

The local health department is responsible for the following groundwater-related functions, as delegated by MDE:

- Evaluating properties for the installation of individual water wells and on-site sewage disposal systems.

- Issuing permits and overseeing the siting and proper installation of private water wells and sewage disposal systems.

- Verifying adequate well yield before a subdivision plan is approved and recorded.

- Verifying that adequate water quantity and quality exists before an individual water well is placed into service.

- Reviewing subdivision plans with respect to environmental impact.

- Evaluating and sampling private domestic water wells, upon owner request, for bacterial and chemical quality.

- Investigating environmental complaints.

- Conducting sanitary surveys to determine the need for community water and/or sewage systems.

- Assisting the MDE with evaluation and permitting Multi-Use Water and Sewerage Systems.

C. <u>WELLHEAD PROTECTION</u>

The State of Maryland currently has regulations that provide minimum wellhead protection to all public water supply wells. Well construction regulations require wells using an unconfined aquifer as a water supply source to be located 100 feet from identifiable sources of contamination and designated subsurface disposal areas. In addition, there are minimum distances set for location of wells away from sewer lines, roads, building foundations and property lines.

The Wellhead Protection Program is a State program involving coordination among several State agencies, Federal agencies and local governments, and agencies to combine regulatory authority to manage all potential sources of contamination in a Wellhead Protection Area (WHPA). This is defined as the surface and subsurface area surrounding a water well or well field, supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or well field.

Delineation of the Wellhead Protection Area is not usually a simple matter of measuring a horizontal distance on the land surface. Maryland extends across eight physiographic regions, which results in extremely varied hydrological settings. The selection of methods and criteria for delineating WHPA's will be complex and varied. As discussed at the beginning of this chapter, Frederick County contains three of six hydrogeologic environments present in Maryland.

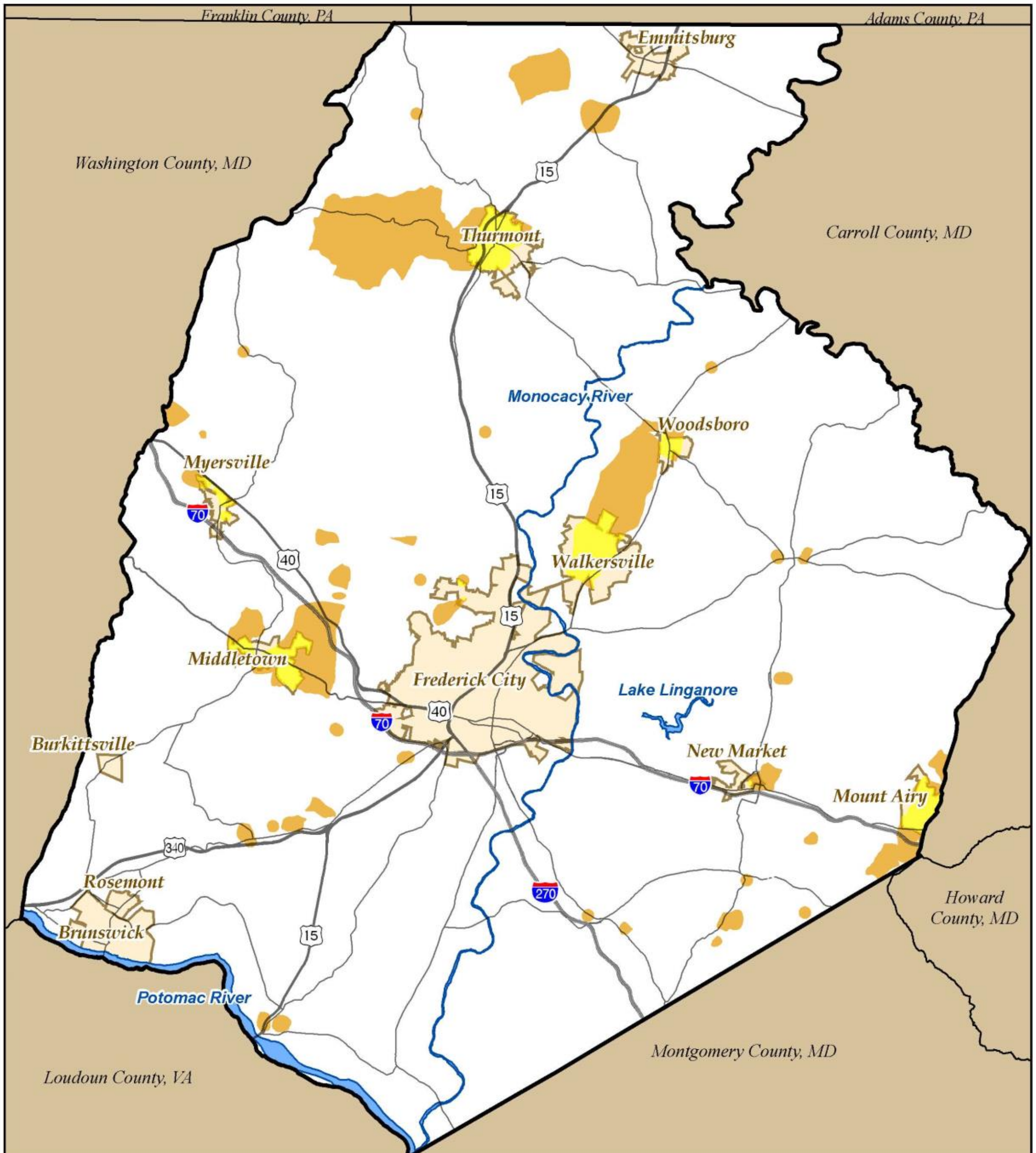
The State has been conducting delineation projects in various environments and has prepared a manual to assist local governments to delineate WHPA's, and has prepared a Model Ordinance for consideration if a jurisdiction wishes to regulate land use for the purpose of wellhead protection.

In response to the Clean Water Act requirement, the state has prepared Source Water Assessments, which inventory and map potential sources of contamination such as underground storage tanks, and other potential sources of contamination in the WHPA of a public drinking water well or well field.

Frederick County, in the interim before delineating WHPA's, enacted legislation that regulates the location of hazardous substance storage tanks in relation to a community water supply system well. In May 2007, the County revised that section of local code. A hazardous substance storage tank must be more than 500 feet from a community water supply system well. Within a WHPA, and greater than 500 ft from a community water supply well, the tank must be above ground and surrounded by a 100% catchment basin or double-walled containment and a spill protection overfill alarm. Outside a WHPA, the tank may be located underground if accompanied by a report from a hydrogeologist stating the nature of the underlying soil, geologic structure, aquifer and the likelihood of contamination of the neighboring water sources in the event the contents of the tank are discharged, and the estimated groundwater travel time. The County may refuse to grant the permit if there is undue danger to the public health, safety or general welfare. The location of all community water supply system wells has been mapped and the tank location regulations are implemented by a permit system, which refers to the maps. In addition, the County amended its Zoning Ordinance with regard to hazardous substance storage tanks. The Permitted Use Table was amended to indicate that several land uses are now prohibited in Wellhead Protection Areas, and they and other uses are marked and cross-referenced to the storage tank section of the Code. The Special Exception requirements for uses, which might involve the storage or leakage of hazardous substances, were amended to cross reference the storage tank section of the Code.

Table 2.06 Source Water Assessments for Public or Private Water Systems

Community	
Town of Emmitsburg	2001
City of Frederick	2002
Town of Middletown	2005
Town of Mount Airy	2000
Town of Myersville	2002
Town of Thurmont	2000
Town of Walkersville	2001
Town of Woodsboro	1997
Fort Detrick	2005
Small Water Systems	
Amelano Manor	
Libertytown Apartments	
Gilberts Mobile Home Park	
Poling Mobile Home Estates	
Spring View Mobile Home Park	
Green Valley Elementary	
Kemptown Elementary	
Lewistown Elementary	
Liberty Elementary	
New Midway Elementary	
Sabillasville Elementary	
Valley Elementary	
Wolfsville Elementary	
Yellow Springs Elementary	
Bradford Estates	2002
Briercrest Apartments	2005
Cambridge Farms	2002
Cloverhill III	2002
Concord Estates Mobile Home Park	2005
Copperfield	2002
Cunningham Falls State Park	2003
Fountaindale	2002
Liberty East	2002
Mill Bottom	2002
Mount St. Mary’s University	2005
White Rock	2002
Windsor Knolls +school	2002



Municipal and Community Wellhead Protection Areas

Deliniated Municipal and Community Wellhead Protection Areas

Deliniated Municipal and Community Wellhead Protection Areas within Incorportated Limits

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April 15, 2011

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D. SINKHOLES

Frederick County contains a vulnerable Karst topography covering about 35 sq. miles. "Karst" describes terrain that is characterized by sinkholes, caves, underground streams, and other features that are formed by the slow dissolution of calcium and magnesium oxides in limestone, dolomite, or marble bedrock. In populated areas, sudden subsidence features known as sinkholes can cause damage to buildings, roads and farmed land, as well as threaten ground and surface water quality by the potential for direct introduction of contaminants. Stream water or surface water runoff that enters a sinkhole can bypass natural filtration through soil and sediment. Groundwater can travel quickly through these underground networks carrying surface contaminants to wells and springs.

Table 2.07 Potential of Selected Soil Series for the Formation of Sinkholes

(Soil scientists from NRCS and geologists from USGS assigned the ratings in this table after they made field observations of the soil series and the underlying bedrock geology. Onsite investigation by a qualified geologist is needed before a determination can be made for interpreting urban and engineering uses of soils for site specific uses).

Soil series	Rating*	Geologic formation * *
Adamstown	Moderate High Moderate High High	Frederick Limestone (Rocky Springs Station Member -- east) Frederick Limestone (Rocky Springs Station Member -- west) Frederick Limestone (Adamstown Member) Frederick Limestone (Lime Kiln Member) Grove Limestone
Athol Athol, rocky phase	Moderate High	Triassic Conglomerate (limestone) Triassic Conglomerate (limestone)
Benevola	Moderate	Sams Creek Metabasalt (Wakefield Marble Member)
Buckeystown Buckeystown, rocky phase	High Very high	Grove Limestone Grove Limestone
Conestoga	Low Low Moderate	Marburg Schist (Silver Run Limestone Member) Sams Creek Metabasalt Sams Creek Metabasalt (Wakefield Marble Member)
Dryrun	Moderate High Moderate High	Frederick Limestone (Rocky Springs Station Member-east) Frederick Limestone (Rocky Springs Station Member west) Frederick Limestone (Adamstown Member) Frederick Limestone (Lime Kiln Member)
Duffield	Moderate High Moderate High	Frederick Limestone (Rocky Springs Station Member - - east) Frederick Limestone Rocky Springs Station Member - - west) Frederick Limestone (Adamstown Member) Frederick Limestone (Lime Kiln Member)
Downsville	Moderate	Frederick Limestone (Adamstown Member)
Funkstown	Moderate High Moderate High Low Moderate	Frederick Limestone (Rocky Springs Station Member - - east) Frederick Limestone (Rocky Springs Station Member - west) Frederick Limestone (Adamstown Member) Frederick Limestone (Lime Kiln Member) Sams Creek Metabasalt Sams Creek Metabasalt (Wakefield Marble Member)
Hagerstown Hagerstown, rocky phase	High High Very high Very high Very high	Frederick Limestone (Lime Kiln Member) Frederick Limestone (Rocky Springs Station Member – west) Frederick Limestone (Adamstown Member) Frederick Limestone (Lime Kiln Member) Grove Limestone
Letort	Low Moderate Low	Sams Creek Metabasalt Sams Creek Metabasalt (Wakefield Marble Member) Marburg Schist (Silver Run Limestone Member)
Morven	Low	Triassic Conglomerate (limestone)
Murrill	Moderate	Frederick Limestone (Rocky Springs Station Member -- east)

	High Moderate High High	Frederick Limestone (Rocky Springs Station Member - west) Frederick Limestone (Adamstown Member) Frederick Limestone (Lime Kiln Member) Grove Limestone
Opequon	Moderate High High High High	Frederick Limestone (Rocky Springs Station Member -- east) Frederick Limestone (Rocky Springs Station Member - west) Frederick Limestone (Adamstown Member) Frederick Limestone (Lime Kiln Member) Grove Limestone
Ryder	Moderate High ModerateHigh High	Frederick Limestone (Rocky Springs Station Member -- east) Frederick Limestone (Rocky Springs Station Member west) Frederick Limestone (Adamstown Member) Frederick Limestone (Lime Kiln Member) Grove Limestone
Springwood Springwood, rocky phase	Moderate High	Triassic Conglomerate (limestone) Triassic Conglomerate (limestone)
Walkersville	Moderate Moderate High High	Frederick Limestone (Rocky Springs Station Member -- east) Frederick Limestone (Adamstown Member) Frederick Limestone (Lime Kiln Member) Grove Limestone
Wiltshire	Moderate	Sams Creek Metabasalt (Wakefield Marble Member)

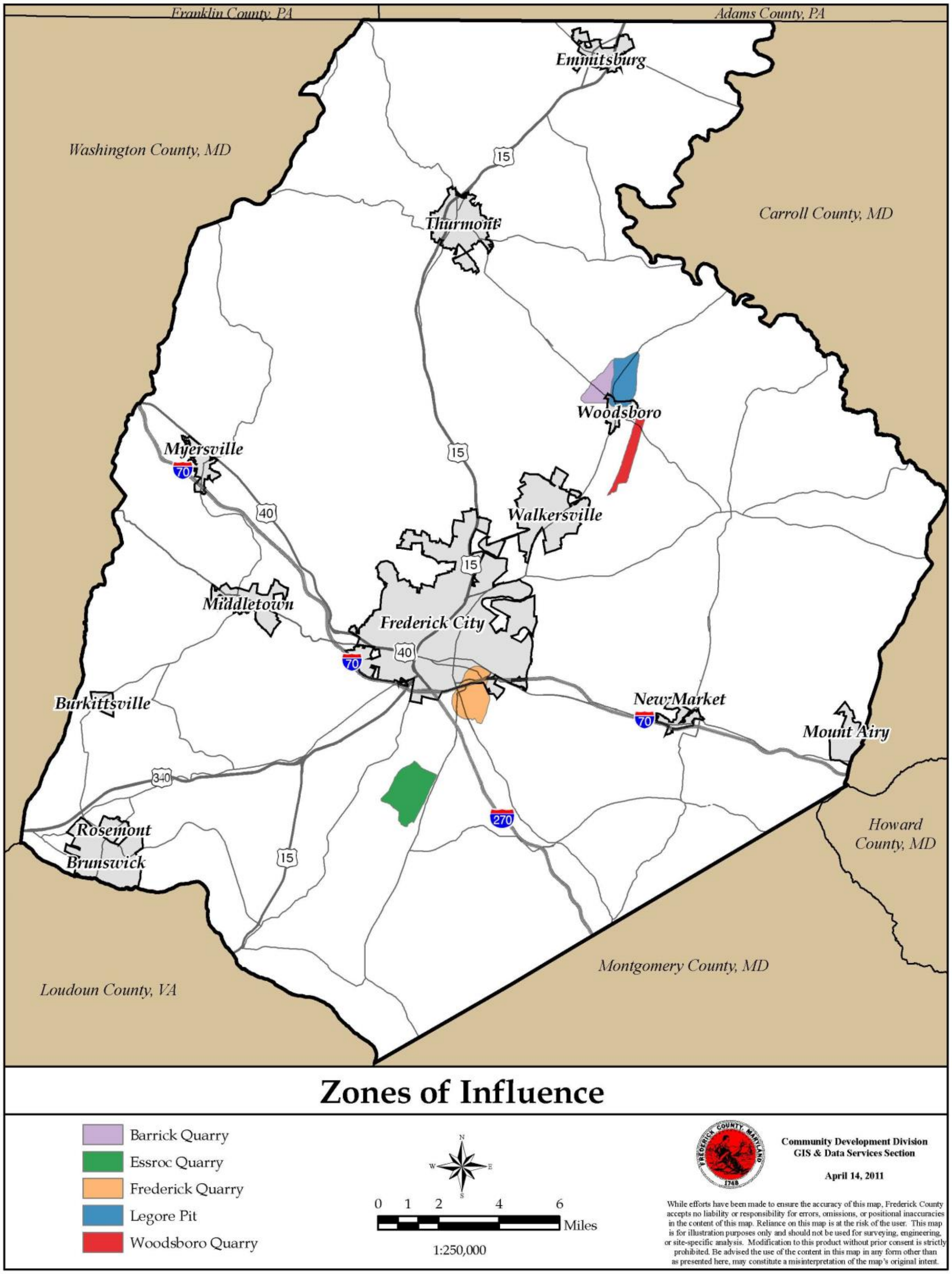
Source: Soil Survey of Frederick County, Maryland. United States Department of Agriculture and the Natural Resources Conservation Service, 2002.

*   Ratings are only assigned to soil series that have shown potential for sinkhole formation. A rating of "low" indicates a less than 1 percent chance of sinkhole formation; "moderate," 1 to 5 percent; "high," 5 to 20 percent; and "very high," more than 20 percent. If a soil has been disturbed, the assigned rating should be increased to the next higher rating where appropriate.

**   Rocky Springs Station Member - - east indicates the east side of Frederick Valley, and Rocky Springs Station Member - - west indicates the west side of Frederick Valley.

E. <u>ZONES OF INFLUENCE</u>

Under a 1991 Amendment to Maryland's Surface Mining Law, the Maryland Department of the Environment (MDE) is required to establish and define Zones of Influence (ZOI's) around limestone and marble quarries in Baltimore, Carroll, Frederick, and Washington Counties. Limestone mining operations are required to repair a sinkhole within a ZOI if MDE determines that the sinkhole resulted from quarry dewatering. Extraction companies are also required to replace a water supply that fails due to declining water levels caused by a quarry's pumping operation. The following quarries have delineated Zones of Influence: LeGore/Barrick, Lehigh, Martin Marietta (Frederick Quarry), and Essroc.



Franklin County, PA
Adams County, PA
Emmitsburg
Washington County, MD
15
Thurmont
Carroll County, MD
Woodsboro
Myersville
70
15
40
Walkersville
15
Middletown
Frederick City
40
70
New Market
70
Mount Airy
Burkittsville
340
270
Howard County, MD
Rosemont
Brunswick
15
Montgomery County, MD
Loudoun County, VA
Zones of Influence
Barrick Quarry
Essroc Quarry
Frederick Quarry
Legore Pit
Woodsboro Quarry
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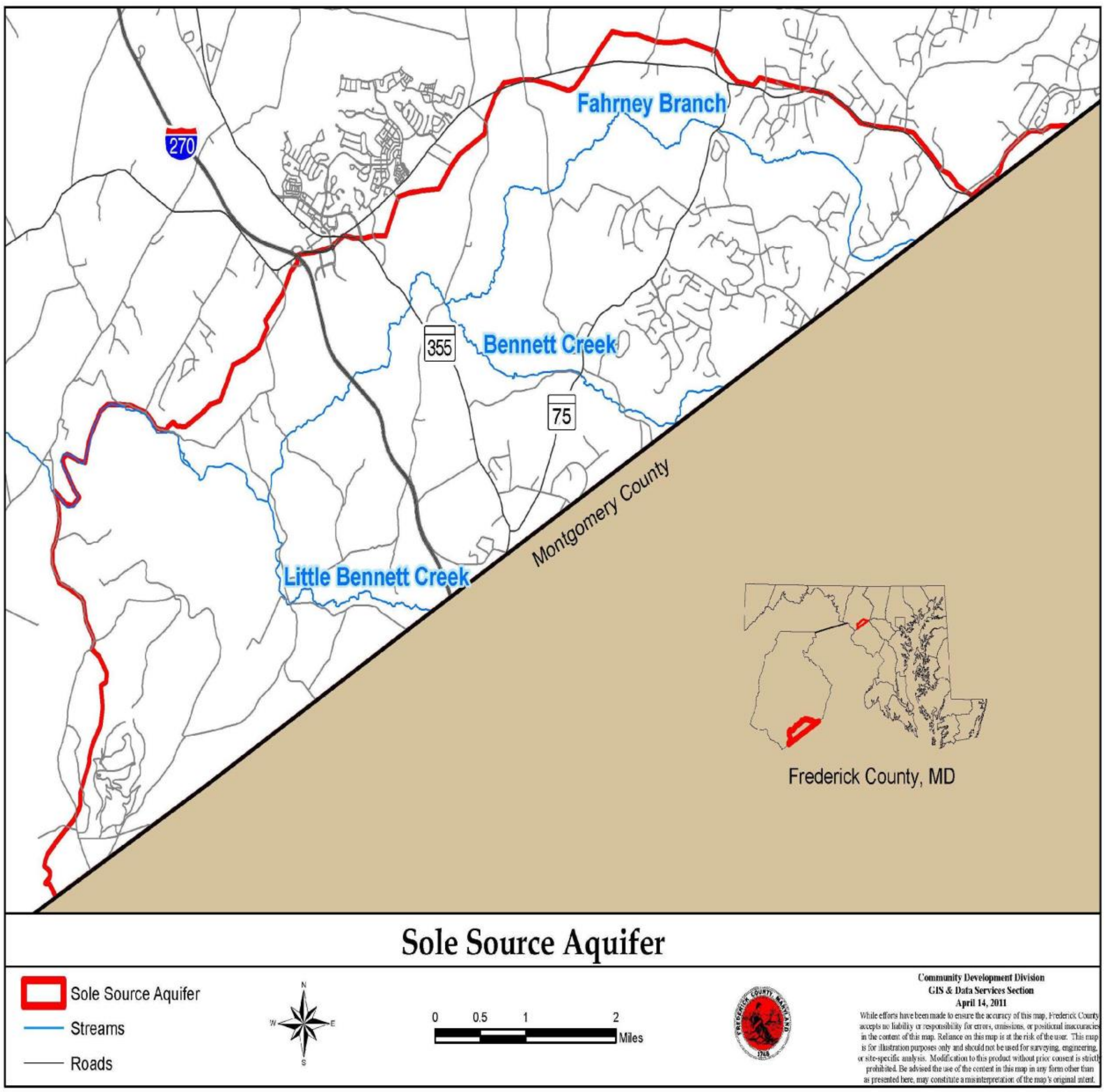
F. SOLE SOURCE AQUIFER

On August 27, 1980, several drainage basins in the southeastern portion of the County and in Montgomery County were designated by the US Environmental Protection Agency (EPA) as a Sole Source Aquifer under the Safe Drinking Water Act of 1974 Section 1424(e). The EPA defines a sole or principal source aquifer as one that supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer. These areas can have no alternative drinking water source(s), which could physically, legally, and economically supply all those who depend upon the aquifer for drinking water. The designation means that any future project in the area funded with federal assistance would be subject to review by EPA for potential impact on the groundwater system and additional pollution prevention requirements. The drainage basins in Frederick County, which are included in this area, are Bennett Creek and Little Bennett Creek to their confluence, and Fahrney Branch to its confluence with Bennett Creek. This area is also known as "Green Valley" and the Sole Source Aquifer designation is reflective of the substantial amount of low-density residential development on individual groundwater wells that exist outside of designated public water and sewer service areas in this portion of the county.

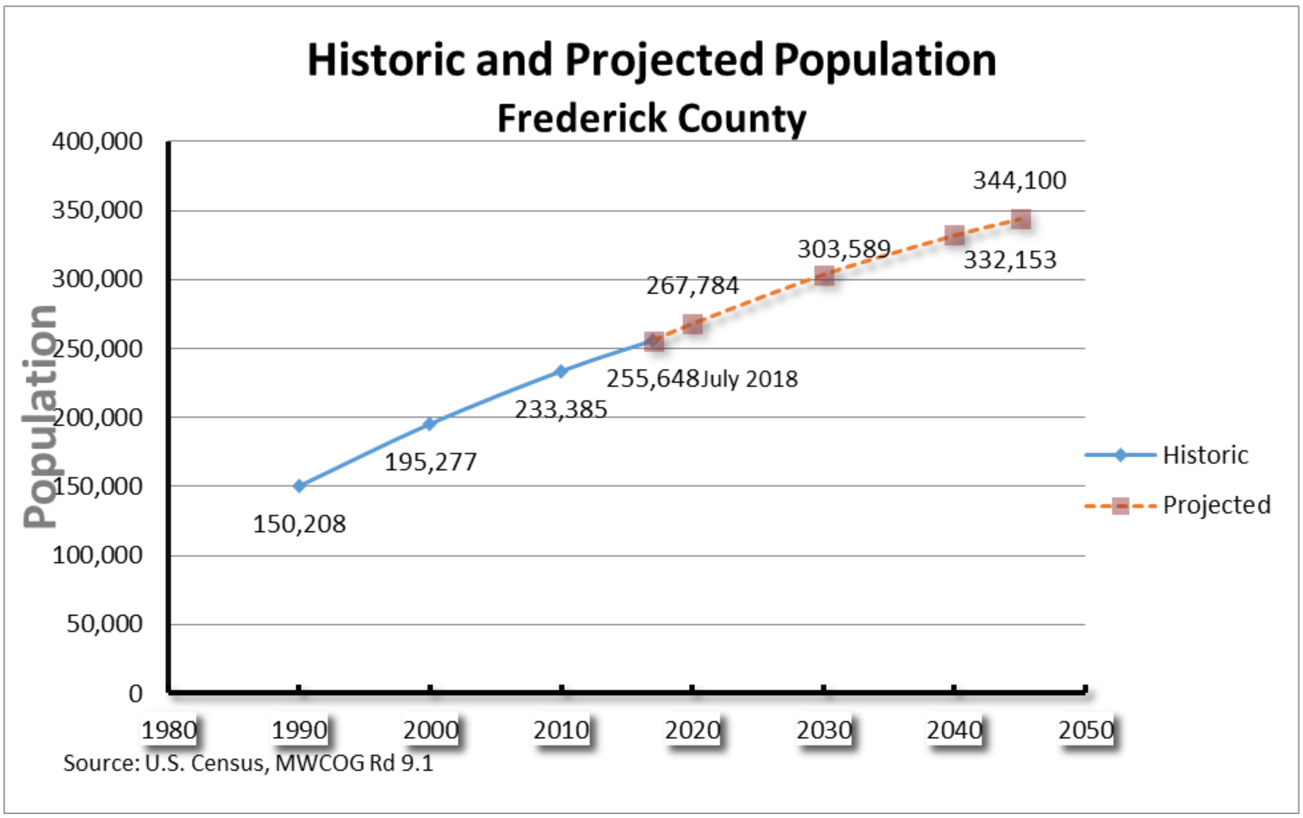


III. POPULATION & LAND USE

A. FREDERICK COUNTY GROWTH TRENDS

The County's 2010 population (US Census Bureau) was 233,385, which includes the City of Frederick's population of 65,239. From 2000 to 2010 the County's population has increased by 19% or 38,108 people. The County's estimated population as of July 2018 was 255,648. From 2010 to 2020 the County's population is projected to increase by 34,399 people or 15%.

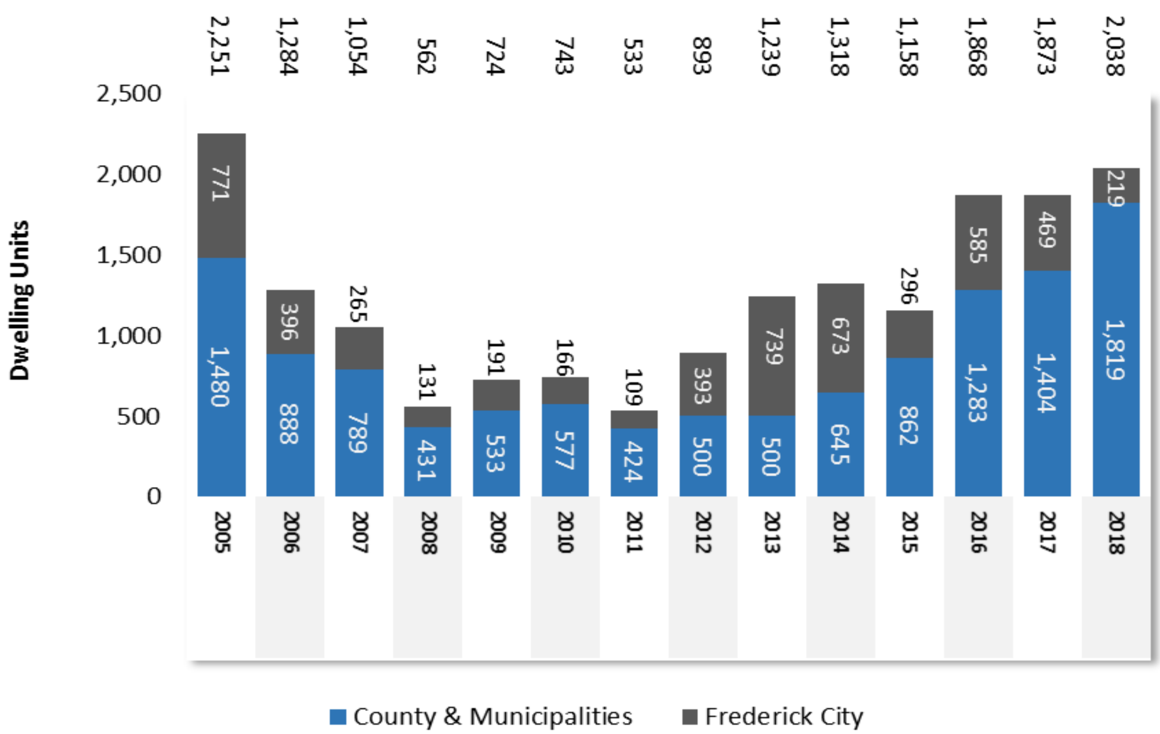
The graph below shows the County's historic and projected population out to 2045. The projected populations below were prepared as part of the Metropolitan Washington Council of Governments Cooperative Forecasting process, Round 9.1, which was adopted in October 2018.



As in the Washington, DC Region generally, household sizes in the County will decline, but not to the same extent as the Washington metropolitan area. The County's current household size is 2.69, which is projected to decline to 2.65 in 2020.

Housing construction between 2000 and 2007 averaged 1,800 dwellings per year, which includes activity within all of the County's municipalities. During the recession period from 2008—2012 the County averaged 640 dwellings/year, which was a 40-year low. Since the recession residential building activity has continued to increase year to year. For the post-recession period from 2012 – 2019 the County has averaged 1,484 dwellings/year. For the past three years from 2016 through 2018 the annual average has increased fairly significantly to 1,926 dwellings/year.

Figure 1: Housing Unit Permits: 2005-2018



Source: Frederick County Planning & Permitting Division

Employment Trends

Several major companies have located in the County in the past three (3) years, including Wegmans (approximately 500 employees), and the Banner Life Insurance Company [now known as Legal and General America] (approximately 400 employees). The US Social Security Administration's National Data Center, located in Urbana, opened in 2014 with approximately 80 jobs.

The Metropolitan Washington Council of Governments (MWCOG) forecasts that two- thirds of new jobs to 2020 will be in the service industries of engineering, computer and data processing, business services and medical research. As a result of the economic recession, job growth in the county and the Washington metropolitan area has been relatively flat. The MWCOG Cooperative Forecast in Round 9.1 (October 2018) projects an additional 5,500 jobs in the County between 2015 and 2020.

Municipal Growth Trends

The County has 12 municipalities, with all but Rosemont and Burkittsville, designated as growth areas. Each has their own planning and zoning function and with a few exceptions control their own municipal services such as water or sewer facilities. Mt. Airy, is situated on the County line with the greater portion of both its land area and population within Carroll County.

Table 2.08 Municipal Population Growth

Municipality	Actual Population			Projected Population	
	2000	2010	2018[1]	2020	2030
Brunswick	4,894	5,870	6,364	7,020	9,852
Burkittsville	171	151	163	155	160
Emmitsburg	2,290	2,814	3,137	3,380	3,750
Frederick City	52,767	65,239	72,052	79,400[2]	89,600[2]
Middletown	2,668	3,786	3,879	4,646	5,092
Mt. Airy (F.C. portion)	3,415	3,814	5,540	3,814	3,880
Myersville	1,382	1,626	1,764	2,004	2,439
New Market	427	656	728	1,120	3,617
Rosemont	284	294	318	300	210
Thurmont	5,588	6,170	6,752	6,200	6,408
Walkersville	5,192	5,800	6,281	6,250	6,500
Woodsboro	846	1,141	1,240	1,300	1,600
Municipal Sub-total	79,924	97,711	107,495	115,589	133,108
County Total	195,277	233,385	255,648	267,784[2]	303,589[2]

Source: US Census, for 2000 and 2010;

1. Maryland Department of Planning, July 2018
2. MWCOG Cooperative Forecast Round. 9.1, October 2018

B. LAND USE & ZONING

An understanding of existing land use patterns and past trends will aid in the understanding of the current Comprehensive Plan and the pattern of existing and proposed water and sewerage service areas. The most significant land use changes have occurred since 1960; prior to this time, the communities, which existed, had been established in the 1800's or earlier and only gradual changes occurred when new residences were built along the rural roads.

The 1970's were a period of rapid development in Frederick County. In the late 1960's, Frederick City annexed over 4,200 acres, most of which were developed in the 1970's. Residential subdivisions proliferated throughout the County. The Lake Linganore PUD was established as well as the Eastalco industrial facility.

In contrast, the 1980's was a period of more concentrated development. The Ballenger Creek area south of Frederick City emerged as an intensive, urbanized area following the construction of a regional sewage treatment plant and water system. This was the only significant concentration of medium and high density housing units, commercial, office and industrial land uses outside of a municipality.

The 1990's continued the pattern of concentrated development. The Linganore and Spring Ridge PUD's and the Urbana PUD saw increased development and the planned industrial area southeast of Urbana began to develop. The New Market and Urbana Regions in general saw the greatest increase in housing growth.

In 2012 the County completed a Comprehensive Plan/Zoning Review of the 2010 Comprehensive Plan. Requests for changes in the either the land use plan designation and/or zoning were reviewed and ultimately adopted on September 13, 2012 with amended Land Use Plan and Zoning Maps. While the Land Use Plan and Zoning maps are still current, the recent adoption of the Livable Frederick Master Plan on September 3, 2019 has replaced the County Comprehensive Plan document adopted in 2010.

Table 2.09 Land Use Plan Designation and Zoning

Land Use Plan Designation[1]	Comp Plan (acres)	% of County	Zoning[2] (acres)	% of County
Agricultural	218,063	50.7%	236,741	55.5%
Commercial / Industrial/Mixed Use	13,261	3.0%	12,603	2.9%
Institutional	2,991	0.69%	1,247	0.3%
Natural Resource	113,433	26.4%	98,401	23.0%
Residential	41,139	9.5%	35,958	8.4%
Transportation Right of Way (ROW)	13,424	3.1%	13,404	3.1%
Municipal*	27,312	6.3%	28,490	6.7%
TOTAL	429,627	100%	426,844	100%

*denotes only land area within municipalities
[1] As amended on September 13, 2012
2 as of November 2018

Residential Land Use

Historically residential development activity has been focused within the County's municipalities with the City of Frederick accommodating the greatest portions. Residential development within the County has been focused in those areas with public water and sewer including the Ballenger Creek, Urbana, and Linganore communities. A recent trend in residential development has been an increase in the construction of multi-family projects. From 2012 to 2016 multi-family dwellings accounted for a significantly higher proportion of new dwellings than has been typical. During this period multi-family dwellings have accounted for a range of 31% to 51%. This trend may have run its course as activity in 2017 and 2018 has been down to more typical levels with 22% and 21% of total new dwellings respectively. This activity has occurred both within the City of Frederick and the County.

Commercial and Industrial Land Use

Since the recession the market for office/employment uses has been flat in Frederick as it is in much of the Washington metropolitan area. Non-residential construction activity has been focused on industrial flex space and commercial uses primarily restaurant and hotel uses. Much of the commercial uses are located within the municipalities primarily the City of Frederick. The primary area for commercial and industrial development within the County continues to be the MD 85 corridor just south of the City of Frederick and into the Ballenger Creek community. Newer areas for commercial and employment development are developing in the MD 180/I-70 area (Jefferson Technology Park) and along the I-270/MD 355 corridor in the Urbana community. In Urbana, along the I-270 corridor, a recent rezoning in 2017 replaced proposed office/employment uses with residential. Approximately 3.4 million square feet of office/employment space, from the Urbana Town Center MXD and the Urbana Office Research Center was eliminated as a result of the rezoning.

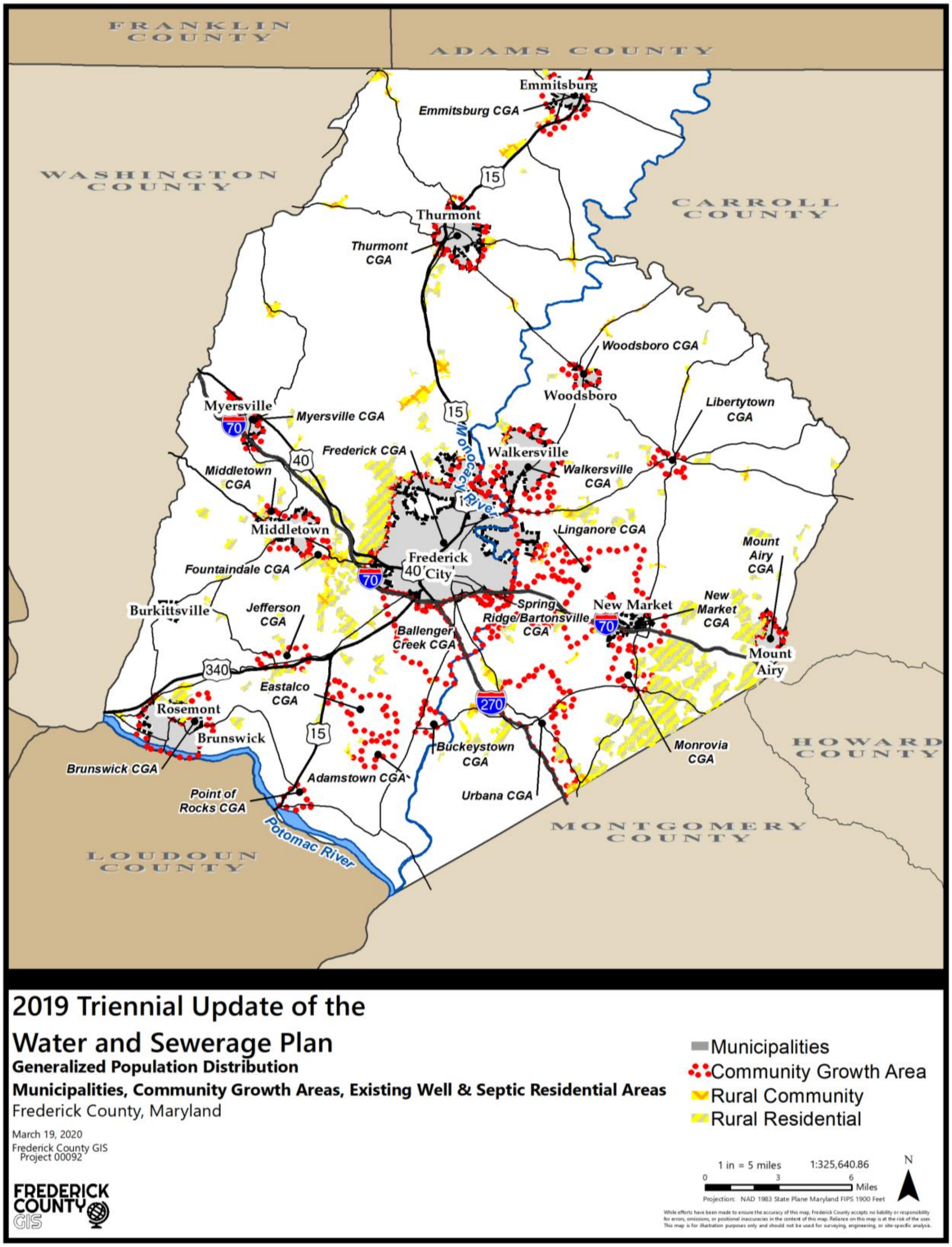
Natural Resource Lands

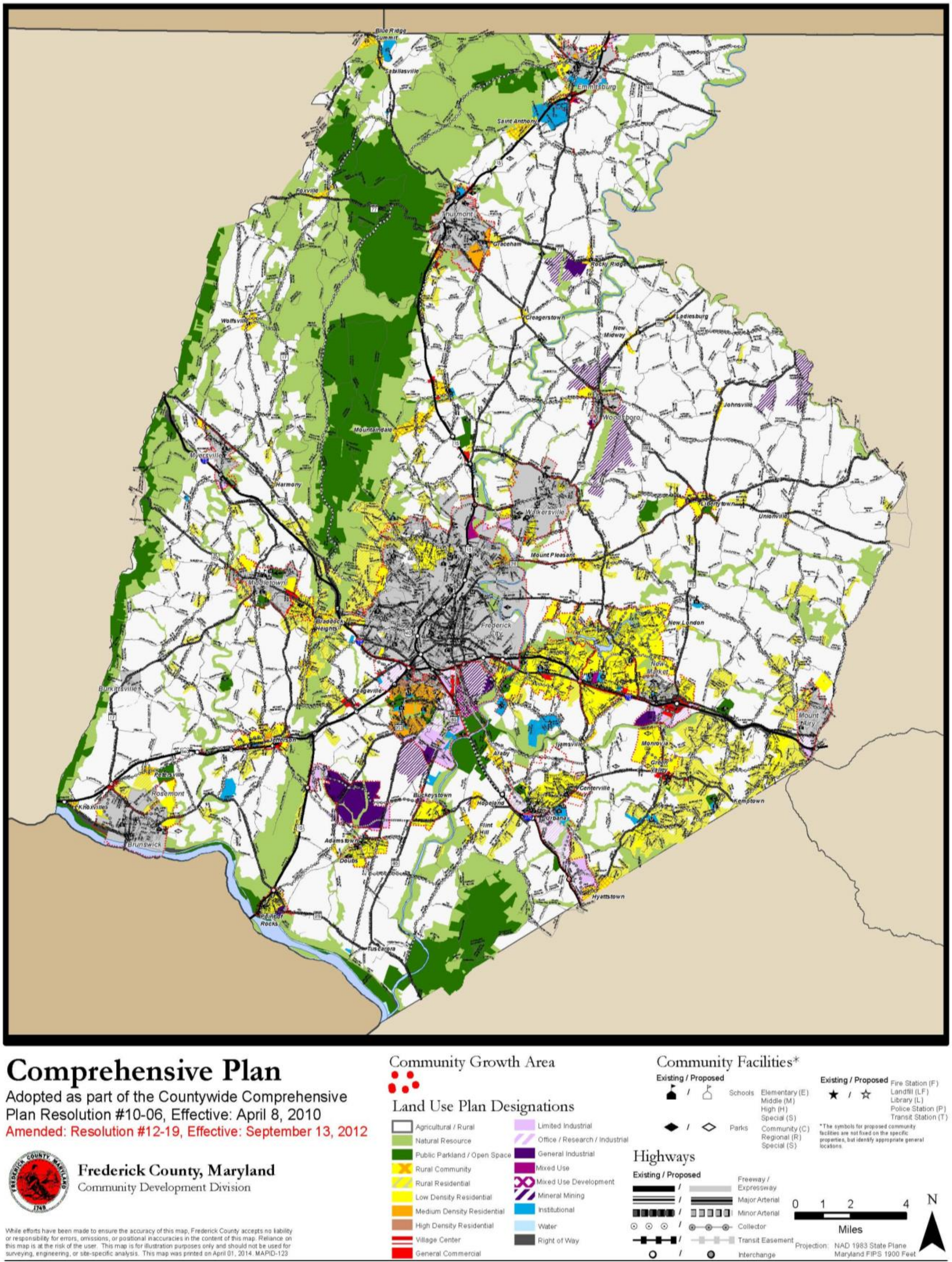
Frederick County includes several features representative of the Blue Ridge province including Catoctin Mountain, South Mountain, and Sugarloaf Mountain. Other significant resource features include the Monocacy and the Potomac Rivers. The mountain areas with their steep slopes and large areas of contiguous woodlands are primarily zoned Resource Conservation which does permit limited residential subdivision at a density of one dwelling per ten acres. The Resource Conservation zoning also exists along other major stream systems, and the floodplains associated with the Monocacy and Potomac Rivers.

Agriculture

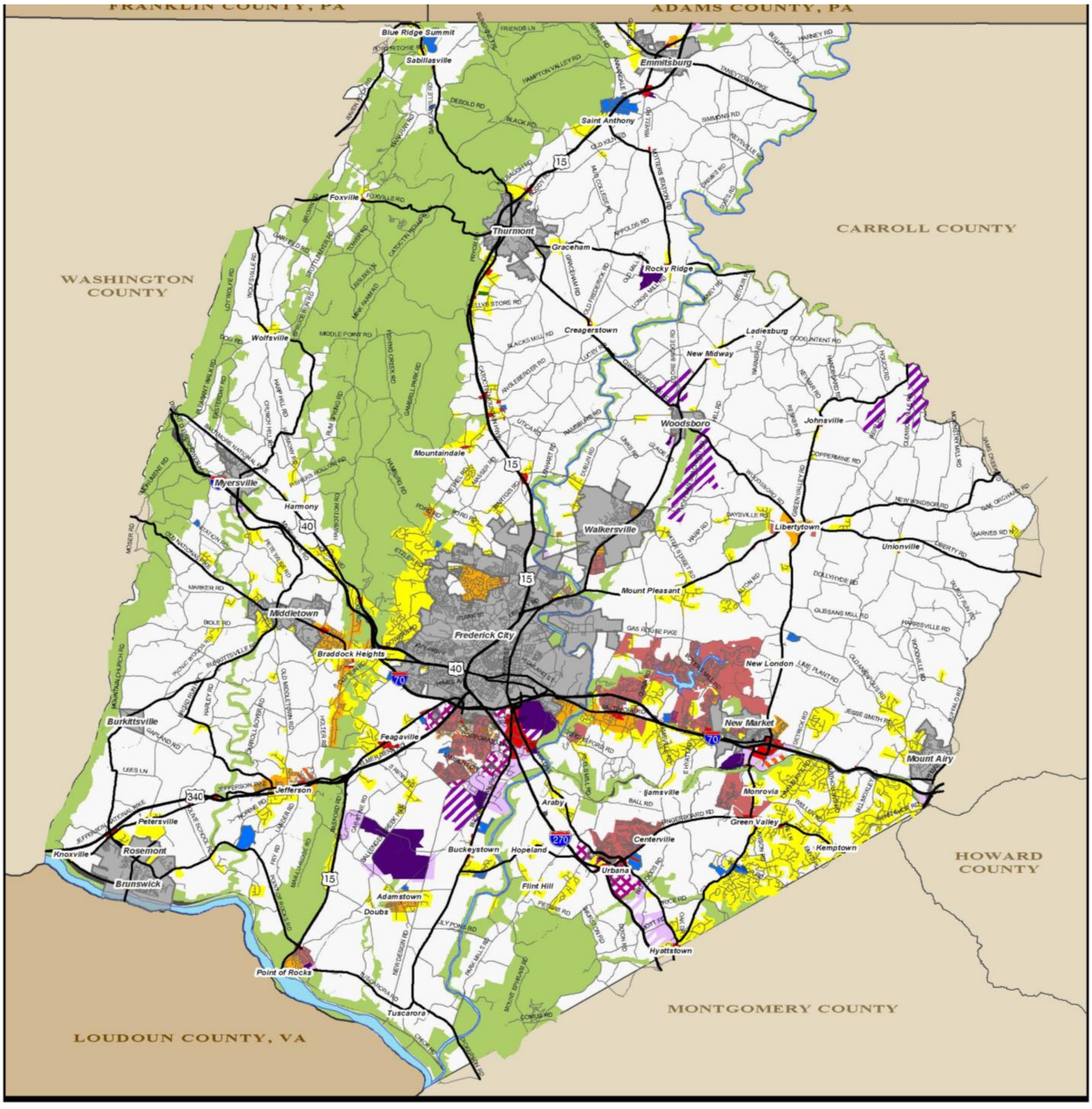
The highest percentage of land use in the County is still agriculture comprising 50% of the County's land area with the Natural Resource land use designation equaling 26% of the County. The County's Agricultural zoning permits very limited residential subdivision by permitting only 3 lots and a remainder parcel to be subdivided from an original tract of land that existed as of August 1976. Additional subdivision rights are available with a cluster provision.

The County has a very active Agricultural Preservation Program comprised of state and county programs to permanently protect agricultural lands As of December 2018, 60,931 acres are under permanent easements. The agricultural preservation areas have been concentrated in the northeast part of the County as well as in the Middletown Valley and Adamstown areas.


FRANKLIN COUNTY
ADAMS COUNTY
WASHINGTON COUNTY
CARROLL COUNTY
HOWARD COUNTY
MONTGOMERY COUNTY
LOUDOUN COUNTY
Emmitsburg
Emmitsburg CGA
15
Thurmont
Thurmont CGA
Woodsboro CGA
Woodsboro
Libertytown CGA
Myersville
Myersville CGA
70
40
Frederick CGA
Monocacy River
Walkersville
Walkersville CGA
Middletown CGA
Middletown
Linganore CGA
Frederick City
Fountaindale CGA
Mount Airy CGA
Burkittsville
Jefferson CGA
Spring Ridge/Bartonsville CGA
New Market
New Market CGA
Ballenger Creek CGA
Mount Airy
340
Eastalco CGA
270
Rosemont
Brunswick
Buckeystown CGA
Monrovia CGA
Brunswick CGA
Adamstown CGA
Urbana CGA
Point of Rocks CGA
Potomac River
2019 Triennial Update of the
Water and Sewerage Plan
Generalized Population Distribution
Municipalities, Community Growth Areas, Existing Well & Septic Residential Areas
Frederick County, Maryland
March 19, 2020
Frederick County GIS
Project 00092
FREDERICK COUNTY GIS
Municipalities
Community Growth Area
Rural Community
Rural Residential
1 in = 5 miles
1:325,640.86
0
3
6
Miles
N
Projection: NAD 1983 State Plane Maryland FIPS 1900 Feet



Comprehensive Plan
Adopted as part of the Countywide Comprehensive Plan Resolution #10-06, Effective: April 8, 2010
Amended: Resolution #12-19, Effective: September 13, 2012
Frederick County, Maryland
Community Development Division
While efforts have been made to ensure the accuracy of this map, Frederick County accepts no liability or responsibility for errors, omissions, or positional inaccuracies in the content of this map. Reliance on this map is at the risk of the user. This map is for illustration purposes only and should not be used for surveying, engineering, or site-specific analysis. This map was printed on April 01, 2014. MAPID-123
Community Growth Area
Land Use Plan Designations
Agricultural / Rural
Natural Resource
Public Parkland / Open Space
Rural Community
Rural Residential
Low Density Residential
Medium Density Residential
High Density Residential
Village Center
General Commercial
Limited Industrial
Office / Research / Industrial
General Industrial
Mixed Use
Mixed Use Development
Mineral Mining
Institutional
Water
Right of Way
Community Facilities*
Existing / Proposed
Schools
Elementary (E)
Middle (M)
High (H)
Special (S)
Parks
Community (C)
Regional (R)
Special (S)
Existing / Proposed
Fire Station (F)
Landfill (LF)
Library (L)
Police Station (P)
Transit Station (T)
*The symbols for proposed community facilities are not fixed on the specific properties, but identify appropriate general locations.
Highways
Existing / Proposed
Freeway / Expressway
Major Arterial
Minor Arterial
Collector
Transit Easement
Interchange
0 1 2 4
Miles
Projection: NAD 1983 State Plane Maryland FIPS 1900 Feet
N



Zoning

Adopted as part of the Countywide Comprehensive Plan Ordinance #10-05-540, Effective: April 8, 2010

Amended through 2018

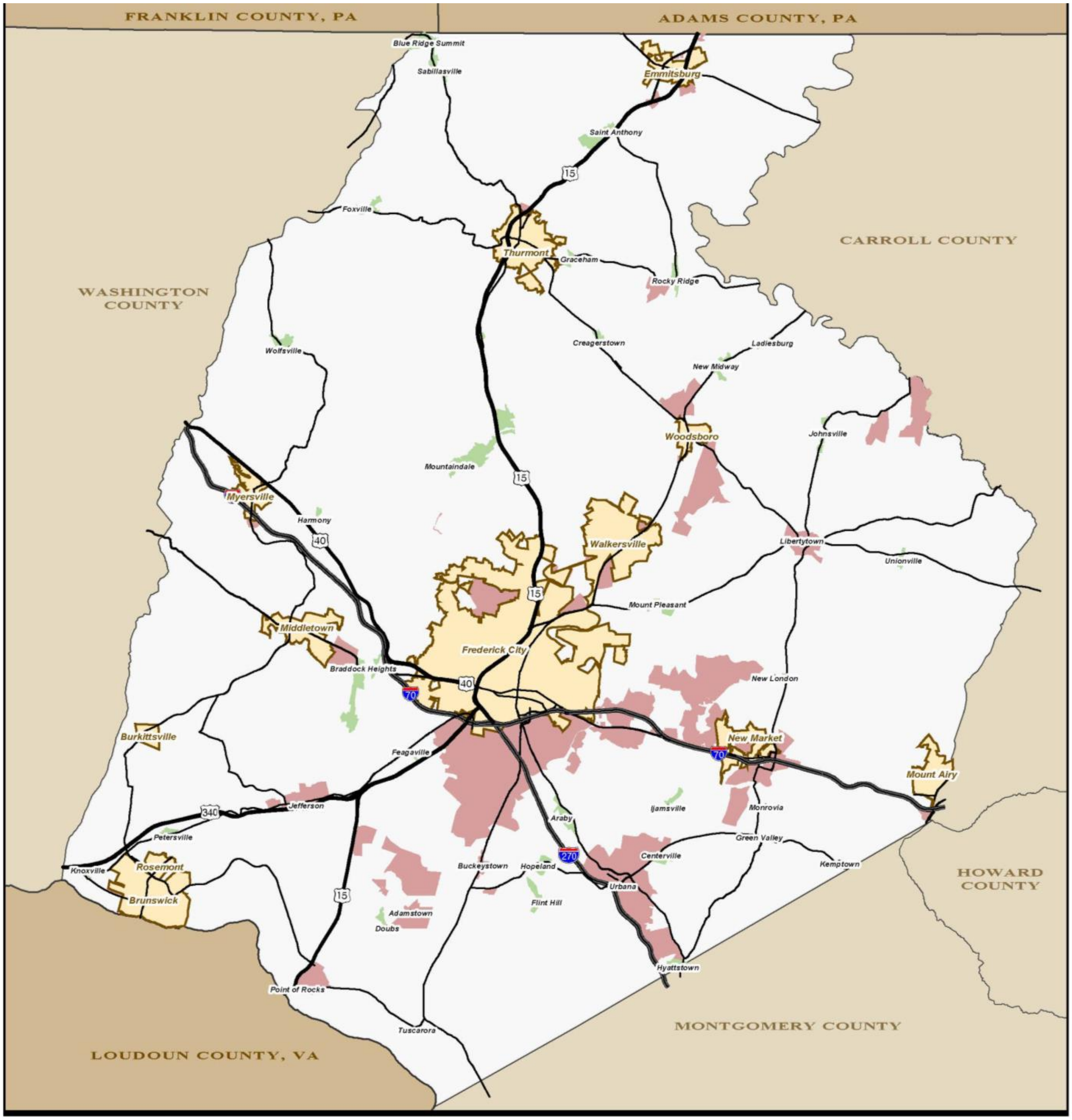
- A – Agricultural
- RC – Resource Conservation
- OSR- Open Space Recreation
- R1 – Low Density Residential
- R3 – Low Density Residential
- R5 – Middle Density Residential
- R8 – Middle Density Residential
- R12 – High Density Residential
- R16 – High Density Residential
- PUD – Planned Unit Development
- VC – Village Center
- GC – General Commercial
- GI – General Industrial
- LI – Limited Industrial
- ORI – Office/Research/Industrial
- MX - Mixed Use
- MXD – Mixed Use Development
- MM – Mineral Mining
- Ie - Institutional
- Municipality
- Right of Way

N

Frederick County, Maryland
Division of Planning and Permitting

0 2 4 8 Miles

Projection: NAD 1983 State Plane Maryland FIPS 1900 Feet While efforts have been made to ensure the accuracy of this map, Frederick County accepts no liability or responsibility for errors, omissions, or positional inaccuracies in the content of this map. Reliance on this map is at the risk of the user. This map is for illustration purposes only and should not be used for surveying, engineering, or site-specific analysis. This map was printed on January 16, 2019. MAPID-92



Priority Funding Areas

Certified September 7, 2010,
Amended September 10, 2018

County
Rural Village
Municipality

Frederick County, Maryland
Division of Planning and Permitting

N

0 2 4 8 Miles

Projection: NAD 1983 State Plane Maryland FIPS 1900 Feet
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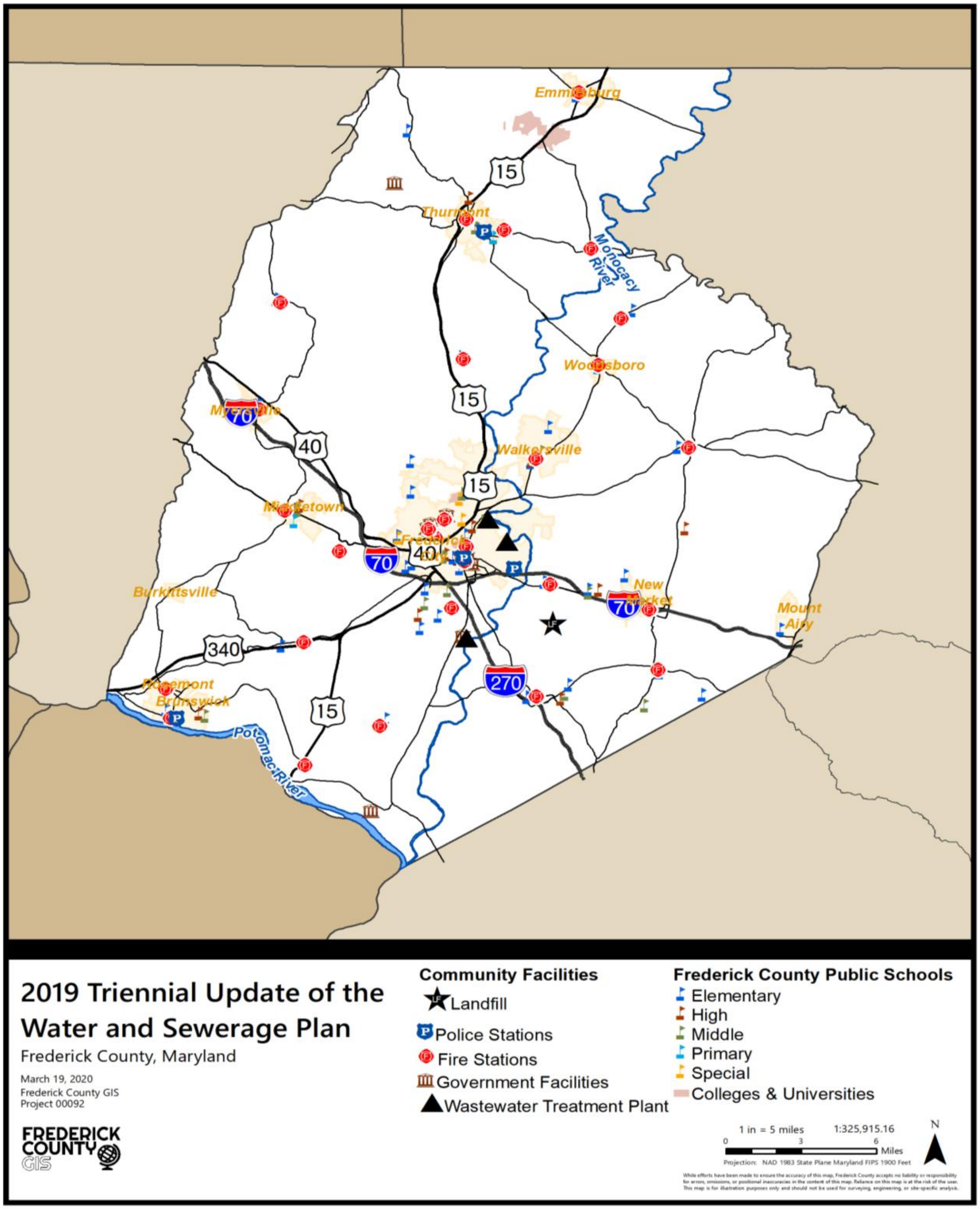
Emmitsburg
Thurmont
Monocacy River
Woodsboro
Myersville
Walkersville
Middletown
Frederick
Burkittsville
New Market
Mount Airy
Rosemont
Brunswick
Potomac River
15
40
70
340
270
2019 Triennial Update of the Water and Sewerage Plan
Frederick County, Maryland
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Frederick County GIS
Project 00092
FREDERICK COUNTY GIS
Community Facilities
Landfill
Police Stations
Fire Stations
Government Facilities
Wastewater Treatment Plant
Frederick County Public Schools
Elementary
High
Middle
Primary
Special
Colleges & Universities
1 in = 5 miles
1:325,915.16
0 3 6 Miles
Projection: NAD 1983 State Plane Maryland FIPS 1900 Feet
N

Table 2.10 Major Institutions and Facilities

Governmental Complex	2020 Approximate Population/Employees
Winchester Hall	190
30 North Market Street	90
Frederick City Hall	56
Frederick City Annex	58
Frederick County Courthouse	450
Fleet Services Facility	38
Health Department Building	200
Division of Utilities & Solid Waste Management Headquarters	40
Bourne Building	51
Foxville Naval Facility (federal)	200
U.S. Army Garrison, Ft. Detrick (federal)	8,330
Governmental Service Facilities	
Fire Stations (29 system wide)	110 (career firefighters staff 22 stations)
Law Enforcement Center	255
Detention Center	160 (corrections staff) 426 (average inmate population)
Reichs Ford Road Landfill	37
Ballenger-McKinney WWTP	6
Ft. Detrick WWTP	4
City of Frederick WWTP	5
New Design WTP	4
Health Care Facilities	
Frederick Health & Frederick Health Medical Group	2,700 (system wide employees)
Montevue Assisted Living/Citizens Care & Rehabilitation Center	300 (employees)
Educational Institutions	
Hood College	2,500 students & 410 faculty/staff (2019)
Mt. St. Mary's University	2,200 students & 689 faculty/staff (2019)
Frederick Community College	16,000 students & 1,000 faculty/staff (2019)
County Elementary Schools (37 system wide)	19,218 students & 1,510 faculty/staff (2018)
County Middle Schools (13 system wide)	9,955 students & 784 faculty/staff (2018)
County High Schools (10 system wide)	12,837 students & 982 faculty/staff (2018)
Public Charter/Other	1,215 students & 92 faculty/staff (2018)